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# National Energy Board

## REASONS FOR DECISION

In the matter of the Applications under Part III  
of the National Energy Board Act

of

TRANSCANADA PIPELINES LIMITED

Q & M PIPE LINES LTD.

APRIL 1980





1 Canada

2  
1 NATIONAL ENERGY BOARD

3  
1 REASONS FOR DECISION

In the Matter of the Applications Under Part III of  
the National Energy Board Act

of

TransCanada PipeLines Limited and  
Q & M Pipe Lines Ltd.

April 1980

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IN THE MATTER OF the National Energy Board Act  
and the Regulations made thereunder;

AND IN THE MATTER OF applications made by Alberta and  
Southern Gas Co. Ltd., Canadian-Montana Pipe Line  
Company, Columbia Gas Development of Canada Ltd.,  
ICG Transmission Limited, Niagara Gas Transmission  
Limited, ProGas Limited, Sulpetro Limited, and  
Westcoast Transmission Company Limited for licences  
under Part VI of the National Energy Board Act for  
the export of natural gas to the United States of  
America;

AND IN THE MATTER OF a joint application made by  
Pan-Alberta Gas Ltd., TransCanada PipeLines Limited,  
and Consolidated Natural Gas Limited, for licences  
under Part VI of the National Energy Board Act for the  
export of natural gas to the United States of America;

AND IN THE MATTER OF applications by Q & M Pipe Lines  
Ltd., TransCanada PipeLines Limited, and ICG  
Transmission Limited for certificates of public  
convenience and necessity under Part III of the National  
Energy Board Act;

#### CERTIFICATE PHASE

Heard at Ottawa, Ontario on 25, 26, 27, and 28 September 1979; 1, 2, 3, 4,  
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Halifax, Nova Scotia on 14, 15, and 16 January 1980; Fredericton, New  
Brunswick on 17 January 1980; Ottawa, Ontario on 22, 23, 24, 28, 29, and  
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ABBREVIATIONS OF NAMES (Preliminary)

"ADEQ"	-	Association des agents de développement de l'Est du Québec
"AERCB"	-	Alberta Energy Resources Conservation Board
"AGTL"	-	The Alberta Gas Trunk Line Company Limited
"Algonquin"	-	Algonquin Gas Transmission Company
"Amoco"	-	Amoco Canada Petroleum Company Ltd.
"BAPE"	-	Bureau des Audiences Publiques des Services de l'Environnement
"BP"	-	B.P. Canada Inc.
"CGA"	-	Canadian Gas Association
"Consolidated"	-	Consolidated Natural Gas Limited
"Consumers'"	-	The Consumers' Gas Company
"CPA"	-	Canadian Petroleum Association
"CRDEQ"	-	Conseil régional de développement de l'Est du Québec
"D.C. MacCharles"	-	University of New Brunswick
"Dome"	-	Dome Petroleum Limited
"Dow"	-	Dow Chemical of Canada Limited
"Gaz Inter-Cité"	-	Gaz Inter-Cité Québec
"Gaz Métropolitain"	-	Gaz Métropolitain, inc.
"Great Lakes"	-	Great Lakes Gas Transmission Company
"Gulf"	-	Gulf Canada Limited and Gulf Canada Resources Incorporated
"HBOG"	-	Hudson's Bay Oil and Gas Company Limited
"ICG Scotia"	-	ICG Scotia Gas Limited
"IGUA"	-	Industrial Gas Users Association
"Imperial"	-	Imperial Oil Limited
"Inter-City"	-	Inter-City Gas Limited
"IPSCO"	-	Interprovincial Steel and Pipe Corporation Ltd.
"IPAC"	-	Independent Petroleum Association of Canada
"IPL"	-	Interprovincial Pipe Line Ltd.
"Manitoba"	-	Attorney General of the Province of Manitoba



"Maritime Electric"	-	Maritime Electric Company Limited
"Midwestern"	-	Midwestern Gas Transmission Company
"Mobil"	-	Mobil Oil Canada Ltd.
"New Brunswick"	-	Government of New Brunswick
"New Brunswick Power"	-	New Brunswick Power Corporation
"Newfoundland"	-	Government of Newfoundland and Labrador
"Niagara"	-	Niagara Gas Transmission Limited
"Norcen"	-	Norcen Energy Resources Limited
"Nova Scotia"	-	The Province of Nova Scotia
"Nova Scotia Power"	-	Nova Scotia Power Corporation
"Ontario"	-	Minister of Energy of the Province of Ontario
"OPEC"	-	Organization of Petroleum Exporting Countries
"Pan-Alberta"	-	Pan-Alberta Gas Ltd.
"Petro-Canada"	-	Petro-Canada
"PGAC"	-	Propane Gas Association of Canada
"Polar Gas"	-	Polar Gas Limited
"Québec"	-	Procureur Général du Québec
"Q & M"	-	Q & M Pipe Lines Ltd.
"Saskatchewan"	-	Saskatchewan Department of Mineral Resources
"SCIDA"	-	Strait of Canso Industrial Development Authority
"Shell"	-	Shell Canada Resources Limited
"SOQUIP"	-	La Société Québécoise d'Initiatives Pétrolières
"SOTAR"	-	La Société Technique d'Aménagement Régional Inc.
"STELCO"	-	Steel Company of Canada
"Texaco"	-	Texaco Canada Inc.
"TransCanada" or "TCPL"	-	TransCanada PipeLines Limited
"TransCo"	-	Trans-Continental Gas Pipe Line Corporation
"Ultramar"	-	Ultramar Canada Limited
"Union Gas"	-	Union Gas Limited
"Wood Energy"	-	Wood Energy Consultants Limited

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ABBREVIATIONS OF TERMS

"CD"	-	Contract Demand
"CPI"	-	Consumer Price Index
"EJ"	-	Exajoules ( $10^{18}$ joules)
"GDPFC"	-	Gross Domestic Product at Factor Cost
"GJ"	-	Gigajoules ( $10^9$ joules)
"GNE"	-	Gross National Expenditure
"GNP"	-	Gross National Product
"GW.h"	-	Gigawatt-hour
"ha"	-	hectare
"KV"	-	Kilovolt
"mg/l"	-	milligrams per litre
"MJ"	-	Megajoules ( $10^6$ joules)
"MW"	-	Megawatt
"m <sup>3</sup> /d"	-	Cubic meters per day
"10 <sup>3</sup> m <sup>3</sup> "	-	Thousand cubic metres
"10 <sup>6</sup> m <sup>3</sup> "	-	Million cubic metres
"10 <sup>9</sup> m <sup>3</sup> "	-	Billion cubic metres
"10 <sup>12</sup> m <sup>3</sup> "	-	Trillion cubic metres
"PJ"	-	Petajoules ( $10^{15}$ joules)
"SGS"	-	Small General Service
"SNG"	-	Synthetic Natural Gas
"TJ"	-	Terajoules ( $10^{12}$ joules)

REFERENCE REPORTS

- |                        |  |
|------------------------|--|
| "1978 Oil Report"      | - Canadian Oil Supply and Requirements - National Energy Board - September 1978.   |
| "1979 Gas Report"      | - Canadian Natural Gas Supply and Requirements - National Energy Board - February 1979.  |
| "Licence Phase Report" | - Reasons for Decision in the Matter of Applications Under Part VI of the National Energy Board Act - National Energy Board - November 1979  |
| "Interim Report"       | - Reasons for Decision in the Matter of Applications Under Part III of the National Energy Board Act of TransCanada PipeLines Limited and Q & M Pipe Lines Ltd. and in the Matter of an Application under Section 60 of the National Energy Board Act of TransCanada PipeLines Limited - National Energy Board - February 1980 |
| "Quebec White Paper"   | - An Energy Policy for Quebec, Insurance for the Future - Government of Quebec, 1978   |



## DEFINITIONS

Candide	A large computerized econometric model of the Canadian economy which has been developed by the Economic Council of Canada with the assistance of several departments of the Federal Government. The development of the model has been proceeding since 1970, and a recent version, CANDIDE 1.2M, was developed in 1976. The model being used at the Board is the 1.2M version with further modifications made by Board staff.
Capture Rate	The proportion of newly constructed buildings for which a particular fuel is selected to meet their heating loads.
City-Gate Price	The average price charged by a natural gas transmission company for gas delivered at a 100% load factor at the point of delivery, or sale, to a gas distribution company.
Eastern Zone	For rate design purposes, the TransCanada PipeLines system is divided into five zones. The Eastern Zone encompasses the geographic area from North Bay to Montreal, including Toronto and southern Ontario. Within the Eastern Zone all distributors pay the same rate for a given service.
Heating Degree-Days	A unit measuring the extent to which the outdoor mean daily dry-bulb temperature (average of maximum and minimum) falls below 18° Celsius. One degree-day is counted for each degree of deficiency below the assumed base temperature of 18° Celsius, for each calendar day on which such deficiency occurs. (On the Fahrenheit scale, the assumed reference temperature is 65°F.)
Heavy Fuel Oil	In this report the term heavy fuel oil is used to include bunker fuel oils which are No. 5 and No. 6 fuel oils and also industrial fuel oil which is No. 4 fuel oil.
Import Leakages	In the context of regional economic impact analysis, this means the flows of funds going to imports of goods and services from outside of the impact region.

International Price of Crude Oil	A generalization for the "going price" of crude oil in the world markets.
Light Fuel Oil	In this report the term light fuel oil is used to include furnace fuel oil which is No. 2 fuel oil and stove oil which is No. 1 fuel oil. The major volume of light fuel oil used in Canada is furnace fuel oil.
Liquefied Natural Gas	The light hydrocarbon portion of natural gas, predominantly methane, which has been liquefied.
Load Factor	The actual volume of gas taken under a gas sales contract compared to the contracted quantity.
Refinery-Gate Price	The delivered price of crude oil to a refinery, including all transportation charges to that point.
Servitude	A charge or burden resting upon one estate for the benefit or advantage of another; a species of incorporeal right derived from the civil law and closely corresponding to the "easement" of the common law, except that "servitude" has relation to the burden or the estate burdened, while "easement" refers to the benefit or advantage or the estate to which it accrues.
34° OPEC Marker Crude	Saudi Arabian light crude oil with a gravity of 34° API, often used as a benchmark to price other crude oils in the world market.
Toronto Reference Price (Toronto City Gate)	The price of Alberta gas delivered at Toronto, determined as an energy equivalent value of the price of crude oil at Toronto, in accordance with Federal-Alberta gas-pricing agreements.
Wellhead	Specifically, the equipment placed on top of a well at the surface to maintain control of the well. More generally, it is used to specify a delivery point in the production system, e.g. the wellhead price.
World Price	See "International Price"

METRIC CONVERSION TABLE

1 cubic foot of natural gas gas (@ 14.73 psia and 60°F)	=	0.028 327 84 cubic metres
1 cubic metre of natural gas	=	35.301 cubic feet
1 Btu 60/61	=	1 054.615 joules
1 Mcf (@14.73 psia)	=	28.327 84 m <sup>3</sup>
1 MMcf (@14.73 psia)	=	28 327 840 m <sup>3</sup> or 28.326 84 x 10 <sup>3</sup> m <sup>3</sup>
1 Bcf	=	28 327 840 m <sup>3</sup> or 28.327 840 x 10 <sup>6</sup> m <sup>3</sup>
1 x 10 <sup>3</sup> m <sup>3</sup>	=	35.301 Mcf
1 x 10 <sup>6</sup> m <sup>3</sup>	=	35.301 MMcf
1 x 10 <sup>9</sup> m <sup>3</sup>	=	35.301 Bcf

RULES OF THUMB (approximately equivalent volumes of natural gas)

1 GJ	=	0.95 Mcf
1 TJ	=	0.95 MMcf
1 PJ	=	0.95 Bcf
1 EJ	=	0.95 Tcf





## CHAPTER 1

### INTRODUCTION

The National Energy Board ("the Board"), in its Order No. GH-4-79, issued on 7 May 1979, provided for a two-phase public hearing on applications for licences to export natural gas ("Licence Phase") and on applications for certificates of public convenience and necessity to construct and operate pipeline facilities in Quebec and the Maritimes ("Certificate Phase").

The Licence Phase of the hearing was held in July and August 1979, and the Board's report, dated November 1979, was released on 6 December 1979. In the Licence Phase of the hearing, in determining the volumes of surplus available for export, the Board made allowance for the demand of expansion markets in Quebec and the Maritimes. Thus, volumes of gas needed to supply the requirements of the areas to be served by the proposed new pipelines have already been set aside by the Board.

The Certificate Phase of the hearing began in Ottawa on 25 September 1979 and, following sessions in Quebec City, Halifax, and Fredericton, concluded in Ottawa on 30 January 1980.

In the Certificate Phase of the hearing, the Board heard evidence on two applications to extend natural gas pipeline facilities from Montreal, Quebec, to Halifax, Nova Scotia. These applications are described in detail in Chapter 2 of this report. Briefly, TransCanada PipeLines Limited applied to extend its natural gas pipeline from Montreal to Quebec City. Q & M Pipe Lines Ltd. proposed to build a natural gas pipeline from Quebec City to Halifax.

Near the conclusion of the hearing, TransCanada requested the Board to give expedited consideration to the initial section of its proposed pipeline involving the crossing of the Lake of Two Mountains, near Oka, Quebec. This request was made without prejudice to the applications for certificates filed by TransCanada and Q & M. TransCanada stated that, for environmental reasons, the crossing of the Lake of Two Mountains could only be constructed in the summer months, and if it were not constructed in the summer of 1980, natural gas service to new market areas would be delayed by one year.

On 21 March 1980, the Board released an interim decision, issuing a certificate to TransCanada for the construction of the first section of its proposed pipeline, including the crossing of the Lake of Two Mountains. This first section, some 54 kilometres in length, extends from the terminus of TransCanada's existing pipeline at St. Lazare, near Montreal, to Boisbriand, on the North Shore of the St. Lawrence River.

In its interim decision, the Board stated its intention of issuing at a later date its full reasons for decision and its decision in the matter of the two applications that were before it in the Certificate Phase of the hearing. This current report, therefore, deals with the entire application of TransCanada, including those facilities already approved by the Board in its interim decision, as well as the application of Q & M Pipe Lines Ltd.

The natural gas pipelines proposed by the Applicants represent the first major extension of the Alberta to Montreal pipeline since its completion in 1958.

Numerous parties intervened in the Certificate Phase of the hearing. All provinces east of Alberta, with the exception of Prince Edward Island, took part, as did the two petroleum associations, CPA and IPAC, as well as the gas and propane associations, CGA and PGAC. Producing companies participated in the hearing, as did several of TransCanada's existing distributors and IGUA.

Interventions were also received from various associations and individuals in the areas to be traversed by the proposed pipelines, and, in order to permit these intervenors to make their views more fully known to the Board, sessions of the hearing were held in Quebec City, Halifax and Fredericton.

Within succeeding chapters, TransCanada is dealt with first, followed by Q & M. The Applicant's evidence is followed by the evidence or positions taken by intervenors and then by the views of the Board.

The positions taken by intervenors are summarized in Chapter 3 of the report. Views of intervenors on specific issues are reflected in subsequent chapters of the report.



Chapters 4 and 5 of the report deal with natural gas requirements and supply.

Chapter 6 of the report examines the location, design, and cost of the proposed pipeline facilities, as well as right-of-way matters and environmental impact.

Financial matters and contracts are discussed in Chapter 7.

Chapter 8 contains economic assessments, including studies of the regional, social, and economic impacts of the projects, the impact on the refining industry, Canadian content of the projects, and cost-benefit analyses.

Chapter 9 deals with the economic feasibility of the proposed pipelines, while Chapter 10 examines the issue of security of supply and self-reliance.

Finally, Chapter 11 contains the Board's reasons for its decision and the Board's decision.



CHAPTER 2  
APPLICATIONS

In the Certificate Phase of the hearing, the Board considered the applications of TransCanada and Q & M for certificates of public convenience and necessity under Part III of the Act to construct and operate natural gas pipeline facilities from St-Lazare, near Montreal, in the Province of Quebec, through Quebec into the Provinces of New Brunswick and Nova Scotia.

The two applications, as before the Board at the beginning of the hearing, were competitive in that each sought a certificate for facilities from Montreal to Halifax; however, on 5 November 1979, TransCanada and Q & M announced that they intended to merge their interests and were granted leave to amend their respective applications to make them complementary.

In the amended applications, TransCanada sought a certificate for facilities from St-Lazare to Levis/Lauzon, and Q & M sought a certificate for facilities from Levis/Lauzon eastward through Quebec and New Brunswick to Nova Scotia. Also Q & M proposed to construct a lateral to St. Stephen, New Brunswick, which would allow the export of natural gas to the Northeastern United States.

TransCanada

TransCanada operates a large-diameter pipeline system, extending from the Province of Alberta through the Provinces of Saskatchewan, Manitoba, and Ontario to the Province of Quebec, with connections at the international boundary near Emerson, Manitoba, Sault Ste. Marie, Sarnia, and Niagara Falls, Ontario, and Philipsburg, Quebec. The TransCanada system comprises some 9 344 km of pipeline, which transports an average of over 85 million cubic metres of natural gas per day, supplying nearly two million Canadian residential, commercial, and industrial customers in four provinces.

Under its amended application, TransCanada applied to the Board for a certificate of public convenience and necessity under Part III of the Act to construct and operate pipeline facilities in the Province of



Quebec from St-Lazare to Levis/Lauzon, including laterals to Thurso, the Eastern Townships, Beauce, and the Lac-St-Jean region.

This proposed pipeline extension in Quebec would consist of 1 675.5 km of mainline and laterals. The total cost in 1979 dollars of the proposed TransCanada facilities in Quebec would be approximately \$383.5 million for the export case and some \$350.8 million for the non-export case. If exports through the facilities proposed by Q & M were approved, TransCanada would have to install additional facilities in Quebec to transmit increased volumes of gas.

#### Q & M

Q & M is a Company incorporated under the provisions of the Canada Business Corporations Act. All of Q & M's shares are presently held by The Alberta Gas Trunk Line Company Limited.

Under its amended application, Q & M applied to the Board for a certificate of public convenience and necessity under Part III of the Act to construct and operate pipeline facilities in the Province of Quebec east of Levis/Lauzon and in the Provinces of New Brunswick and Nova Scotia.

Q & M's proposal assumed the export of some  $2.57 \times 10^9 \text{ m}^3$  per year of natural gas to the Northeastern United States through a lateral to St. Stephen, New Brunswick.

The Applicants indicated that the export case was their prime case. No application was made for a licence under Part VI of the Act to export gas through the Q & M facilities, but Q & M indicated to the Board that a certificate conditional upon the obtaining of a licence to export gas would be acceptable to it.

The proposed Q & M pipeline would comprise 1 828.7 km of mainline and laterals for the export case and 1 743.4 km for the non-export case, involving a total cost in 1979 dollars of about \$425.1 million and \$337.2 million respectively. In addition, Q & M proposed to construct underground storage facilities for peak-shaving purposes near Sussex, New Brunswick.

Joint Venture

As mentioned above, on 5 November 1979, TransCanada and Q & M announced that they intended to merge their interests and were granted leave to amend their respective applications to make them complementary. TransCanada fully supported the application of Q & M, and Q & M fully supported the application of TransCanada.

The Applicants stated that TransCanada was responsible in an evidentiary sense for the facilities it applied for in the Province of Quebec and that Q & M was similarly responsible for the Maritimes Pipelines. Some of the evidence was adduced jointly by the Applicants.

Some matters pertaining to the joint venture had not been resolved, at the time of the hearing, for full implementation of the joint venture, but the Applicants submitted that this did not affect the substance or validity of the certificates sought. The joint applicants, TransCanada and Q & M, told the Board that although they have agreed between themselves that they would hold any certificate or certificates granted, in a fiduciary relationship for the benefit of both, until assignment of the certificate is approved, TransCanada would remain fully responsible to the Board for any of the facilities in the Province of Quebec up to Lévis-Lauzon, and Q & M would remain fully responsible for any certificate granted in respect of the Maritimes pipeline. The Applicants indicated that they would apply to the Board for a transfer of any certificate to a joint venture corporation.

Besides indicating that a separate corporation would hold the certificate, the joint applicants indicated that they would propose that all facilities for which certificates were being requested by the respective companies would be jointly owned by them and operated by a newly formed company. TransCanada and Q & M would each hold a 50 percent undivided interest in all facilities for which certificates were being applied, which facilities would be connected to the existing TransCanada pipeline system. There was agreement in principle on those matters, but the agreement had not been formalized in writing and therefore no written agreement was filed with the Board.





CHAPTER 3  
INTERVENTIONS

3.1 Introduction

There were 64 intervenors of record in the Certificate Phase of the Omnibus Gas Hearing. Of these 26 provided a statement of interest in the proceedings.

This Chapter will deal with the other 38 intervenors who, through their interventions or submissions, or through the evidence of a witness, or through argument, during the hearing, provided an expression of views or position. Views of Intervenors with respect to specific topics are presented more fully in subsequent chapters of this report.

3.2 Associations

CPA

CPA stated that it was generally in favour of the expansion of natural gas markets, but that the economics of serving such markets must be considered.

The Association believed that natural gas service east of Montreal should be considered in the light of alternative sources of energy, now or in the future.

CPA believed that the pipeline should not at present be built beyond Quebec City and, even in such a circumstance, detailed consideration would have to be given to how gas would penetrate the market, having regard for competing hydro-electricity and heavy fuel oil.

A decision on extending the pipeline to Atlantic Canada was, in CPA's view, premature, in light of the need to assess potential East Coast offshore discoveries of gas and oil and in view of the considerable revenue deficiency associated with financing such an extension.

CPA provided recommendations on the type of subsidy or incentive needed to overcome such a revenue deficiency.

First and foremost, the subsidization should be shared by the producers, through a lower netback as a result of additional upstream

facilities; by the Federal Government, through some form of "supply security" compensation payments to gas distributors; and by the Alberta Government, through the provision of long-term loans to distributors to assist in conversion. In addition, the transmission companies and the beneficiaries of the pipeline, i.e., the consuming provinces, should contribute to the subsidization if such were necessary.

CPA believed the subsidy should be visible, substantial, and of a defined duration; it should take into account the incremental costs of connecting markets; and it should be sufficient to allow gas to penetrate the market.

CPA held that the Q & M pipeline could not be warranted on the grounds of security of supply, stating that the amount of foreign-origin oil displaced would be small, not justifying an expenditure of \$1.5 billion. In addition, the Association rejected outright the sizing of either proposed pipeline to accommodate the proposed gas export at St-Stephen.

CPA believed that for rate-making purpose, a new zone on TCPL's system downstream of Montreal should be established which recognized additional transportation costs, and that the cost of the zone would be funded in some way by the Federal Government, rather than through a reduction in the Alberta border price.

The Association repudiated TransCanada's suggestion of extending the Eastern Zone, stating that this would distort present zoning, which is based on approximately equal mileage and which recognizes increased transportation costs.

#### IPAC

It was the position of IPAC that the Board should issue a certificate allowing the immediate construction of new facilities to new Montreal-area markets, but no farther than Trois-Rivières. IPAC felt that the proposed export case must be ignored.

IPAC saw no economic or other justification for extending service beyond Trois-Rivières, as that area accounted for more than 50 percent of the total potential market for gas substitution in Quebec and the Maritimes.

IPAC believed that before extending gas service eastwards, the relative cost benefit of alternative methods of serving the east should be examined, methods such as the development of tarsands and heavy oil plants dedicated to serve the area, the encouragement of East Coast oil and gas exploration, or the development of coal or tidal power.

Given the lack of economic justification for the project, IPAC examined eastern gas expansion from the viewpoint of security of supply. It concluded that since less than ten percent of the present Maritime oil use would be displaced by gas from the proposed pipeline by 1985, security of supply was not sufficient justification for expansion into the Maritimes.

Moreover, IPAC believed that the present desire of Quebec and Atlantic Canada for increased natural gas service was based on price, not security of supply.

It argued this from two standpoints; first, that it was not until foreign oil prices rose above those of domestic fuels that Nova Scotia supported the proposed pipeline, and second, that neither Quebec nor Nova Scotia was willing to provide substantial financial inducements to gas expansion.

With respect to the whole project, IPAC, like CPA, was concerned with the revenue deficiencies that would exist in the proposed project. It argued that in the absence of government contributions, given the present pricing system, the entire burden of the deficiency would rest on Alberta producers.

IPAC noted that the estimated expenditure of \$3 billion for this pipeline would create no new energy and that on the basis of current gas pricing, no revenue would be left over, after paying transportation costs, to develop new energy supplies.

#### IGUA

IGUA stated that the extension of the pipeline from Montreal to Quebec might be justifiable in relation to security of supply and self-sufficiency, even if some measure of subsidy were required. IGUA was concerned, however, about the economic feasibility of providing gas to Lévis-Lauzon, the Beauce, the Eastern Townships, and Lac St-Jean.

IGUA's particular concern, as expressed in its intervention, was to seek assurance that the price of natural gas to industrial users now served by TCPL would not be adversely affected by any eastern extension of the gas pipeline. IGUA also asked the Board to ensure that mechanisms for making up revenue deficiencies were not simply disguised means of passing on price increases to present customers of TCPL.

IGUA believed that no economic or other case had been made for Maritime expansion. On the cost side, it quoted required subsidies of \$4.20 per Mcf until 1990. On the non-economic side it felt that the small quantities of oil to be displaced, less than five percent of present requirements, if any oil were displaced at all, did not justify expansion. It went on to say that it was possible that alternative energy sources, like coal, might be more beneficial than gas expansion, and that Hibernia oil, or Sable Island gas, might well be better means of meeting Maritime energy requirements.

#### PGAC

PGAC provided the Board with a study entitled "Expanded Markets for Propane". This document defined the potential for domestic propane in Canada; identified the volumes of Canadian propane production in excess of Canadian demand; and examined the historical role played by propane in energy supply, relating that to energy demand in Canada.

Originally, it had been the intention of PGAC to provide the study in connection with TransCanada's original proposal to predevelop gas markets in the Atlantic Provinces with propane. When that scheme was discarded with the merging of the TransCanada and Q & M applications, PGAC nonetheless provided the study to assist the Board in its deliberations.

### 3.3 Producing Companies

#### BP

BP stated that it favoured a natural gas pipeline extension because it would use surplus natural gas, assuming that substitution by natural gas did not curtail the development of alternative energy supplies.



BP believed that natural gas should not be forced into areas requiring large subsidization or where, for example, there was offshore oil potential to offset foreign oil imports.

It was BP's position that synthetic crude or other crude oil developments were a necessary component of a natural gas substitution policy. In this regard, it provided a study showing the relationship between the development of synthetic crude oil and extending the natural gas pipeline in Quebec.

BP's contention in its study was that, although it was desirable to substitute domestic natural gas for oil to reduce Canada's dependence on foreign crude oil, the long-term interests of Canada would make it advisable to develop synthetic crude oil production at the same time.

#### Dome

In its intervention, Dome supported increasing the availability of domestic energy to replace foreign crude oil supplies.

Dome believed that the Atlantic Provinces were entitled to secure domestic resources and that markets for natural gas existed in the area.

#### Gulf

Gulf indicated in its intervention that it supported the national objective of reducing Canada's dependence on crude oil imports, and thus supported introduction of natural gas and other indigenous energy supplies into markets presently served by imported oil.

Gulf believed that construction of the pipeline to Atlantic Canada should be deferred until the potential of new and alternative energy supplies, such as offshore oil and gas and LNG from the Arctic, could be assessed.

Gulf provided an estimate of natural gas demand by sector for new markets in Quebec, which indicated that much of the gas penetration in that province would be at the expense of refined oil products and electricity.

Gulf also provided an assessment of the minimal effect that the expansion of natural gas markets would have on refinery utilization in Quebec and the Maritimes.

#### Mobil

Mobil's interest was stated to be in the possible substantial impact the proposed market extension would have on the wellhead price of natural gas in Alberta. As well, Mobil intervened as a major participant in the potentially significant oil and gas discoveries of offshore eastern Canada.

Mobil provided evidence at the hearing relating to these offshore developments, particularly the exploration activity on Sable Island, which Mobil stated could represent a significant potential supply of natural gas for Nova Scotia by the mid-1980's.

#### Norcen

Norcen, in argument, supported the application of TransCanada, but submitted that a certificate ought not to be granted to Q & M.

With respect to TCPL, Norcen believed that extension of gas service within Quebec would make a major contribution to Canada's energy self-sufficiency. From an economic standpoint, it stated that the additional markets to be added were sufficiently large to justify the construction of new pipeline facilities.

In regard to Q & M, Norcen believed that consideration of the application should be adjourned until there was further evidence on the developments at Hibernia and on Sable Island as well as on the possibility of Arctic LNG shipments; until the costs of alternative energy sources could be ascertained; until demand could be more precisely defined; and until an application had been received by the Board for a licence to export gas at St. Stephen, New Brunswick, through Q & M's proposed facilities or until the pursuit of that application had been abandoned.

#### Petro-Canada

Petro-Canada stated in its intervention that it had substantial interests in gas reserves off the coast of Nova Scotia, including Sable Island, and in other offshore areas.

Petro-Canada intervened to urge the Board to consider the consequences of the Arctic Pilot Project before making a decision on Q & M's and TransCanada's originally proposed pipeline to the Atlantic Provinces.

The Arctic Pilot Project is an application to the Board by Petro-Canada providing for delivery of LNG to a regasification terminal at one of three possible sites in Eastern Canada, for export to the United States by displacement. Petro-Canada stated that the volume of gas involved would be about  $6.4 \times 10^6 \text{ m}^3$  per day. It submitted that the pipeline design approved by the Board should be compatible with the marketing of this volume of gas in Eastern Canada.

#### Shell

In its intervention, Shell submitted that applications to extend natural gas service to the Maritimes should be denied, unless an evaluation of alternative energy showed the economic viability of the proposition or unless the proposal was found to be in the national interest.

With respect to expansion within Quebec, Shell stated that incremental gas sales could be feasible, if, among other things, there were incentive pricing; if the eight percent Quebec sales tax on residential and commercial natural gas sales were removed; and if the surplus of heavy fuel oil in the Province were eliminated.

In the event initiatives were provided to make markets receptive to gas consumption, Shell submitted that the costs of the measures should be shared by all who benefit, that the amount and duration of the incentives and subsidies paid should be defined, and that any incremental markets in areas already receiving gas service should be entitled to share in the benefits of the new measures.

#### Texaco

It was the view of Texaco that the development of new markets was possible without extensive subsidization by the general taxpayer, by local consumers, or by the producers.

Texaco did not support the proposed natural gas pipeline extension, stating that the proposal was uneconomic and would not contribute significantly to the improvement of security of supply. In this respect, Texaco felt that security from disruptions of foreign oil supplies could be better obtained through the storage of a 180-day supply of oil in Canada. The Company also believed the proposed project was premature, when considered in the light of the development of offshore gas supplies, like Sable Island.

Texaco also believed that inter-fuel substitution should occur only if it resulted from competition in the market place.

Texaco felt that a delay in "force-feeding" natural gas into new Eastern Canadian markets would allow the petroleum industry time to develop markets for any products displaced by natural gas. The Company believed that the resources being allocated to the proposed pipeline project could be better directed elsewhere, for example, to assuring that Canada had a greater supply of crude oil.

### 3.4 Other Companies

#### Consolidated

Although in favour of the principle of supplying natural gas to Eastern Canada, Consolidated argued that the Board should not grant a certificate to TransCanada or Q & M until a hearing was held on the export component of the application.

#### Gaz Inter-Cité

Gaz Inter-Cité indicated it supported the extension of natural gas service east of Montreal. It believed the extension of the pipeline east of Montreal would reduce Quebec's dependence on uncertain imported energy by promoting the displacement of fuel oil by gas for heating and other uses. The extension would provide Quebecers with the same advantages offered to Canadians west of Montreal with regard to flexibility and reliability of energy supply, allowing better price opportunities for consumers and providing greater and faster industrialization of underdeveloped areas.



Gaz Inter-Cité presented in its intervention the results of an extensive market study into the potential demand for natural gas in areas unserved by natural gas in Quebec.

Gaz Inter-Cité indicated that it was in a position to undertake all works related to the installation of a fully integrated natural gas distribution system in the expansion areas. It stated further that, assuming the transmission pipeline could be in operation twelve months after a decision by the Board, the distributors would be in a position to connect customers to their own distribution system within a similar period of time.

#### Gaz Métropolitain

Gaz Métropolitain supported the proposed pipeline expansion project on the basis that it would provide natural gas service to markets east of Montreal. In a submission to the hearing Gaz Métropolitain provided the results of an extensive market survey of the demand for natural gas in Quebec. This survey consisted of 104 individual studies providing estimates of gas demand for 23 urban centres in the expansion market, plus separate estimates for its present Montreal franchise area.

Gaz Métropolitain has applied to the Régie de l'électricité et du gaz to be granted the gas distribution franchise in the expansion areas.

Gaz Métropolitain indicated that several measures were needed to ensure penetration of natural gas and to eliminate projected deficits associated with gas distribution in the Quebec market. Among these measures were the elimination of the eight percent Quebec sales tax on natural gas and the establishment of a credit of 38 cents per GJ on the Alberta gas price.

In addition, Gaz Métropolitain recommended the implementation of a development rate by the pipeline carrier, over 36 months, available to distributors, which would result in a cost of gas equal to the rate for the Eastern Zone. Gaz Métropolitain also suggested the indexing of natural gas prices at 80 percent of the crude oil price, instead of the

present 85 percent. The Company also recommended that the price of gas at the burner tip be set ten percent below that of competing fuels in the residential sector and equal to that of the alternatives in the commercial and industrial sector.

### Inter-City

Inter-City believed that the extension of natural gas service further into Quebec and into the Maritimes would have long-term benefits.

Inter-City's stated reason for intervening was that for two years it had been conducting feasibility studies on gas distribution in Quebec, Nova Scotia, and New Brunswick, and was intending to become involved, either directly, or indirectly through a subsidiary, in distributing natural gas in those provinces.

The main thrust of Inter-City's argument was with respect to price. It believed that strong pricing recommendations should be included in the Board's Decision, specifically, that the burner tip price of natural gas should be set at least ten percent below the cost of alternative fuels.

Furthermore, the Company believed that the present subsidies being paid for offshore crude oil, i.e., import compensation, would be better utilized to assist in the expansion of natural gas to areas presently without service.

### ICG Scotia

ICG Scotia intervened because it wanted to be the distributor of natural gas in Nova Scotia. At the hearing, it provided evidence regarding markets and distribution costs in Nova Scotia.

ICG Scotia unequivocally supported the extension of the natural gas pipeline to the Maritimes, because of the economic benefits involved and the benefits associated with security of supply.

ICG Scotia also believed that the Eastern Zone should be extended to the Atlantic Provinces; that there should be incentive pricing at the burner tip; that most or all conversion costs must be paid; and that a use for displaced residual fuel oil must be found.

### Maritime Electric

Maritime Electric is Prince Edward Island's provincial electrical utility, using imported crude oil to generate electricity.

Maritime Electric testified at the hearing that it could obtain two indirect benefits from the proposed natural gas pipeline extension. The first benefit would be that perhaps the utility could obtain any heavy fuel oil or diesel displaced by gas on the mainland. The second benefit would be that if gas were used to generate electricity in New Brunswick, from where Maritime Electric obtains 60% of its electricity via underwater cable, the utility could purchase that electricity.

### Nova Scotia Power

Nova Scotia Power stated that it favoured the construction of a natural gas pipeline to Nova Scotia.

The Corporation, which transports nearly all electrical power for public distribution in Nova Scotia, and which has over 300,000 customers, considered that its thermal power stations offered a substantial potential market for natural gas over a period of five to eight years, prior to the firing of the stations being converted to coal permanently.

Nova Scotia Power also expressed interest during the hearing in distributing natural gas in Nova Scotia. In this regard, it stated that it had commissioned a major comprehensive study and would apply for the franchise.

### Consumers'

Consumers' stated that it had no intention of obstructing the extension of natural gas service to Quebec and the Maritimes, but felt that the proposals of TransCanada and Q & M could not be justified on economic grounds. It was Consumers' view that the proposed project violated the principles of utility economics and could not be approved by the Board on those grounds.

However, Consumers' did note that the Board could approve the proposed extension on the basis that it was required in the national interest. In such a case, the nation as a whole should bear the costs.

Consumers' also made specific comments on certain facets of the proposed pipeline projects.

Consumers' believed that a new zone for rate-making purposes, which reflected transportation costs, should be created for the new market areas.

Consumers' also believed that the pipeline extension should not go to the Maritimes until the economic viability of Sable Island gas and Hibernia crude oil could be assessed.

It was Consumers' view that the Board should not make a decision until satisfactory gas sales contracts had been filed by the Applicants.

#### Ultramar

It was Ultramar's view that the TCPL and Q & M proposals must be viewed within the framework of a comprehensive energy strategy for Eastern Canada, which it stated would remain dependent on imported oil.

In its intervention, Ultramar stated that it supported the applications to extend natural gas service to the east, but that such expansion was not a mechanism by which energy self-reliance could be furthered while surpluses of petroleum products, which gas was to displace, were forecast for Eastern Canada.

It was Ultramar's view that the requirement for crude oil in Eastern Canada would not be reduced by the provision of natural gas service. Crude oil requirements, stated the Company, are determined by the demand for non-substitutable products, particularly motor gasoline, by the quality of available crude oil, and by the ability of refiners to manufacture a high yield of motive fuels. Most important, therefore, for energy self-sufficiency was improving the yield from each barrel of heavy crude oil.

Ultramar suggested several ways to reduce Canada's dependence on foreign crude oil, among which were:

- extend the IPL system to Quebec City;
- cease exports of domestic crude and products refined from domestic crude; and



- promote installation of conversion equipment to upgrade the ever larger supply of heavy crude oil.

### Wood Energy

Wood Energy's stated concern in the hearing was with respect to the wisdom of bringing natural gas into the Atlantic Provinces when such action might deter the development of wood, a fuel indigenous to the Atlantic Provinces.

Wood Energy provided evidence that wood, specifically "densified" wood, could fill a significant portion of the energy market of the Atlantic Provinces, at a cost with which unsubsidized natural gas could not compete. In addition, the use of this fuel would make natural gas available for other Canadian uses or for exports.

Wood Energy supported the extension of natural gas service into the Maritimes as a complement to wood, but believed the pipeline should be delayed until the capacity of offshore natural gas reserves on Sable Island was known.

### 3.5 Other Groups

#### ADEQ

ADEQ submitted to the Board a study depicting the economic impact resulting from the introduction of a gas pipeline in eastern Quebec. In this study, ADEQ gave an economic description of its region as well as of its future economic development.

The study also provided a comparison of eastern Quebec and northwest New Brunswick to demonstrate that, from an economic point of view, eastern Quebec represented a market area equal or superior to northwest New Brunswick.

ADEQ viewed natural gas as an energy source of vital importance for industrial development in the region and felt that this secure source of energy could provide it with economic stability. The denial of gas service was seen as a factor that would have very negative impact on the area's future economic development.

ADEQ made the following recommendations:

- a) that a lateral, originating in St-Gabriel de Kamouraska, be built to Matane and Matapédia; and
- b) that economic and engineering studies be undertaken with the objective of having natural gas reach eastern Quebec.

#### Association des Commissaires Industriels du Québec

The Association believed that all regions in Quebec should have access to natural gas.

Natural gas was seen as providing Quebec with an opportunity to consolidate and diversify its economic structure. The security of supply aspect associated with natural gas was, in its view, an important factor in relation to industrial development.

The Association supported the proposed extension to Halifax, and endorsed the position of ADEQ, which wished the Board to insert a condition in any certificate issued requiring the building of a pipeline to Matane.

The second major point conveyed by the Association was that it supported a uniform price for natural gas throughout all the regions to be serviced in Quebec in order to avoid creating any regional disparities. On this point, the Association felt that laterals, rather than distribution links, should be built to the various regions of Quebec, and that their costs should be rolled in with the transmission project to arrive at a uniform tariff.

The Association's third point was that the Board should proceed quickly to certificate the proposed projects so that natural gas could be available as soon as possible to regions in Quebec. The Association felt that if delays were encountered with respect to the projects, or if certain regions were not supplied with natural gas, numerous investments in the Province would not take place and the Province would be penalized in terms of foregone employment and lost taxes.

Conseil de Développement de la Haute-Mauricie Inc.

The Conseil's position was essentially that, if and when a certificate was issued to TCPL, the Board should condition this certificate to ensure that the pipeline pass through La Tuque or, at the very least, that it reach La Tuque. In its view, since Q & M had included service to La Tuque in its original proposal - quite probably on the basis of certain studies - there was no reason why TCPL should not come to the same conclusion.

The Conseil was of the opinion that its area would soon be attracting new pulp and paper industries. It felt, however, that this advantage would be lost in a situation where La Haute-Mauricie was not supplied with natural gas, while regions with which it competed to attract industry did receive gas service.

Conseil Economique Lévis-Lauzon

The Conseil indicated that, over the last four years, it had considered the idea of gas service being extended to eastern Quebec and it hoped very strongly that the proposed pipeline project would be realized.

The Conseil suggested that it would be important that the routing of the project come as close as possible to existing natural gas sources in Quebec in order to permit the economic exploitation of these reserves.

In its view, natural gas, as a new source of energy, would reduce the area's dependence on imported oil. Moreover, the Conseil was of the opinion that the lack of natural gas had acted against the development of the region in relation to other areas of Canada and that a supply of gas would be a determining factor in the economic development of the area.

The Conseil also felt it would be beneficial if the facilities between Montreal and Quebec were put in place as soon as possible. The Conseil added that, in its view, the installation of the gas transportation system should not impose additional costs on new customers as this would render the penetration of markets more difficult. The Conseil explained that it wanted the same tariff zone for the new market areas as for Montreal and Toronto.

CRDEQ

CRDEQ recommended to the Board that it certificate the pipeline project, but that it attach one of the following conditions stated, in order of preference, to such a certificate:

- a) that the mainline be extended eastward to Mont-Joli, then southward to New Brunswick through the Matapédia Valley while a lateral would be built further east from Mont-Joli up to Matane; or
- b) that a lateral be extended eastward to Matane and that another lateral originating in Mont-Joli be extended southward to New Brunswick through the Matapédia Valley; or
- c) that the mainline be extended to Matane; or
- d) that a lateral be extended to Matane.

In the view of CRDEQ, as gas was a secure energy source, gas service would constitute an important advantage in attracting industry to East Quebec, particularly in the pulp and paper sector.

Another positive aspect of natural gas noted by the CRDEQ was that, once the transmission system was installed, natural gas would not pose any significant threat to the environment.

Corporation de Promotion Industrielle de Sept-Iles

The Corporation was of the view that the Board should grant certificates to both TCPL and Q & M under the condition that an LNG plant be set up in Sept-Iles as had been originally planned by TCPL.

The Corporation felt that the availability of an energy source like natural gas could spur the local mining industry to convert its machinery to the use of gas and would lead to a stabilization in costs and a more competitive position for the industry on world markets.

The Corporation was also of the opinion that the availability of natural gas would permit a more rapid industrialization of the region by offering a greater flexibility in terms of energy sources.



SCIDA

SCIDA supported the construction of a pipeline with the capability of delivering natural gas from Western Canada to Nova Scotia, assuming that the gas was to be sold at a price no greater than that charged at the Toronto city-gate.

SCIDA also supported the construction of a pipeline that could transmit potential eastern Canadian or offshore Canadian natural gas to Central Canada.

In this latter respect, SCIDA made representations in its submission respecting the suitability of the deep-water port in the Strait of Canso as a location to bring ashore Sable Island or Newfoundland offshore gas via pipeline or ship for injection into a pipeline terminal transmitting gas westward.

UPA

UPA did not oppose in principle the construction of a pipeline in Quebec. In its intervention and in evidence at the hearing, UPA expressed the view that it should be considered an intervenor of special status since it represented those bearing the greatest risk from the proposed pipeline, the farmers with land through which the pipeline would pass.

The general theme of UPA's intervention was the desire to receive thorough information from the pipeline company, and to be consulted in advance, either when the final route was being selected, or when dealing with such construction and environmental matters as soil drainage and compaction, or removal and replacement of topsoil. The UPA also expressed a desire to be consulted when procedures were being developed to deal with servitude or compensation for construction damage.

D.C. MacCharles

D.C. MacCharles, Professor of Economics at the University of New Brunswick, focussed mainly on the economic impact of the proposed pipeline on New Brunswick. He also addressed the pricing of natural gas and alternative means of ensuring security of energy supply.

### 3.6 Provincial Governments

#### Manitoba

Manitoba intervened to represent the interest of consumers in Manitoba, especially to ensure that the costs of the proposed pipeline were not borne solely by upstream customers of TCPL.

Manitoba quoted a 1978 Board Decision on IPL in which the Board stated that it was unreasonable to require users of an older system to pay more with an extension than they would pay without it.

Manitoba stated that it would like to see as many Canadians as possible benefit from natural gas service, but, where gas pipeline extensions were uneconomic, any required subsidy should come through federal funding and thus be borne by all Canadians.

Manitoba supported the continuance of transmission rates that reflected the costs incurred for providing the service. Manitoba rejected outright TransCanada's proposed "tilting" of transmission rates, through higher charges to upstream customers, for the purpose of subsidizing transmission service to new eastern markets and believed that unequal unit transmission tolls were unjust and discriminatory.

#### Saskatchewan

Saskatchewan believed that extension of natural gas service to Quebec and the Maritimes could result in a distinct advantage to Canada by relieving its international balance of payment problems to the extent that natural gas replaced imported crude oil.

Saskatchewan stated that the desirability of the pipeline hinged on three things: the availability of long-term Canadian gas supplies to sustain the markets for a satisfactory period of time; the price of gas in the new markets; and the effect of the extension on tariffs in other parts of Canada.

Saskatchewan did not think that the economic viability of the proposed pipeline had yet been demonstrated, stating that the pipeline would cause a substantial and unreasonable increase in the tariffs of upstream customers. In addition, it was Saskatchewan's view that the economic desirability of providing natural gas to markets east of Montreal should be assessed on the basis of true incremental costs.

Saskatchewan also felt that consideration of the pipeline proposal should be given within the context of other alternatives to displace imported oil and to improve security of supply and that alternatives such as increased energy conservation, oil storage, conversion of refineries to produce more light products, increased use of electricity, use of surplus LPG, and the potential use of offshore gas and oil should be examined.

#### New Brunswick

It was the view of New Brunswick that the Board should delay its decision on the TCPL and Q & M applications until sufficient information had been received on the gas supplies from Sable Island and the Arctic Islands and on domestic oil supplies from Western Canada and the Arctic.

In addition, New Brunswick recommended that the Government of Canada carry out a comprehensive analysis of the costs, and benefits, and the socio-economic and environmental impacts on Canada and especially the Atlantic region to determine the best energy option for the area, including effects on employment and economic development.

New Brunswick made several observations with respect to the proposed extension of natural gas, among which were the following:

- action must be taken to reduce the level of crude oil imports and to increase the reliability of remaining foreign oil supplies
- substitution of natural gas to reduce such imports is a realistic objective for Canada
- as moving gas by pipeline is three to five times more expensive than moving an equivalent quantity of oil, it is most economic to use the gas as close to source as possible and move oil over longer distances
- the burner-tip cost of oil would be considerably lower than that of Alberta gas in the Maritimes
- energy from potential offshore areas could be competitive with oil in the Maritimes

- present security of supply in the Atlantic area could be considerably increased at modest cost by the immediate upgrading of IPL facilities and reversing the Portland - Montreal pipeline
- increased conservation could considerably decrease present demand for oil
- Canadian energy prices should be at levels sufficient to provide incentive to investors to continue exploration and development.

#### Newfoundland

In its intervention, Newfoundland stated that its interest lay in the effect the pipeline proposal would have on the development of other energy resources in Atlantic Canada in general and in Newfoundland in particular.

Although not opposed to the introduction of natural gas into Eastern Canada, Newfoundland believed that before a decision was made on the proposed pipeline, the Board or the Federal Department of Energy, Mines and Resources should conduct a comprehensive analysis of the relative costs and benefits of the various energy options for reducing oil imports and supplementing foreign oil in Eastern Canada.

Newfoundland submitted that one of the viable alternatives that should be examined before approval of the pipeline to the east was the potential of surplus hydro-electricity from Newfoundland and Labrador.

Newfoundland also submitted that if gas prices in Eastern Canada were kept artificially low through subsidization, it could impede the development of alternative energy options, like hydro-electricity. Furthermore, submitted Newfoundland, it was possible that low gas prices in the other Atlantic Provinces could put Newfoundland at a disadvantage since its energy prices would not be reduced. In the circumstances, Newfoundland stated that it would like to see some equivalent financial benefit given those provinces not obtaining the benefit of natural gas.

#### Ontario

Ontario supported the extension of the TransCanada system to Quebec City under the condition that the proposed incentive pricing plan was in place, that distribution laterals were included in the



transmission rate base (a concept that Ontario would like to have applied across Canada to assist in making gas available in areas of Ontario not presently served), and that such incentives were sufficient to make the project economic.

Ontario supported as well the extension of the natural gas system to New Brunswick and Nova Scotia, but stated that the Board should defer issuing a certificate until it had conducted a review of Atlantic Canada's energy supply and demand, including consideration of all energy alternatives; until all information had been obtained to demonstrate the economic viability of the proposed pipeline extension, including the service and form of any subsidies (Ontario also wanted to obtain in advance, Alberta's position on the subject); and until better information was available on the potential of Atlantic offshore gas and oil and Arctic potential.

In addition, Ontario believed that other options might be available, which were more economic, to provide the "modest" degree of security of supply natural gas could provide, options like a strategic oil storage, improved oil distribution facilities, and an increased supply and distribution of propane, as had originally been proposed by TransCanada.

Ontario also made comments on specific issues arising from the hearing. It believed a new rate zone for Quebec should be established so that all costs could be identified and allocated, and stated that all upstream costs associated with the new markets could be added to the rate base of the new expansion zone. It did not oppose the extension of the eastern zone tariff to Quebec City provided the present Toronto city-gate pricing arrangement was retained.

#### Québec

In Québec's view, the public convenience and necessity required the extension of the pipeline east of Montreal.

Québec's position was that, while it maintained a high interest in electricity and new energy sources, it was also prepared to encourage an increase in the role of natural gas in the Province's energy balance. Québec stated that its minimum objective was that, by 1990, gas fulfill 12 percent of the Province's requirements for energy.

Québec's interest in gas was derived mainly from three characteristics associated with this energy source: it would reinforce security of supply; it had advantages in terms of the environment; and, it constituted an important factor in the industrialization of the province. In Québec's view, it would be very difficult to justify a decision, at this time, that would delay penetration of gas in Quebec.

With respect to the proposed route and facilities, Québec felt that gas should be made available in as many of its regions as soon as possible, and that changes in routing to supply gas to Sept-Îles, La Tuque, Rivière-du-Loup, and Matane would significantly improve the project.

To facilitate the penetration of gas, Québec stated that, among other things, it would eliminate the sales tax on natural gas. Québec indicated that other measures had been or were being studied in relation to gas penetration. These measures included the possibility of converting provincial government buildings to natural gas and the possibility of eliminating the provincial sales tax applicable to the purchase of natural gas equipment.

Québec repeatedly stated, however, that, in order to achieve any penetration in Québec, gas would have to be competitive with other existing energy sources. In its view, there was both a requirement for ensuring that new customers in Québec did not pay a transportation cost higher than that paid in the present Toronto-Montreal zone and a requirement for subsidizing conversion costs.

Québec thus wanted to ensure that competitive prices would exist by extending the Eastern Zone to include new market areas. Québec agreed that gas producers would bear most of the transportation subsidy required to achieve this objective. However, Québec added that, in their opinion, the Federal Government had a role to play in ensuring this competitive price, partly so because of the benefits accruing to Canada from the proposed project.

Speaking about conversion subsidies, Québec indicated that it had had staff level discussions with Alberta which had led to a recommendation, among other things, that rebates generated by reducing

the price of gas from 85 percent to 65 percent, relative to the price of oil at Toronto, could serve to subsidize the conversion costs of new customers in Quebec. This agreement, it was stated, had yet to be ratified by the Government of Alberta.

#### Nova Scotia

Nova Scotia was concerned with reducing its current large dependence on insecure foreign oil supplies. It stated that it had three ways of helping to overcome this dependence: increased conservation; increased use of coal for thermal-electric generation; and the use of natural gas. The net result of these options was forecast to be an eventual reduction in dependence on foreign oil from the current 80 percent of primary energy requirements to about 45 percent.

Nova Scotia did not want the Board to postpone a decision on extending the natural gas pipeline until the alternatives, like Hibernia oil and Sable Island gas, could be assessed.

An immediate decision would bring gas to Nova Scotia within two years, while a delay to assess alternatives might involve an extra three to six years.

Nova Scotia felt that expansion of natural gas service into Quebec and Atlantic Canada would have a number of important advantages for Canada, the most important of which were improved security of supply and self-sufficiency and an improved balance of payments picture.

Nova Scotia believed that the burner tip price of natural gas in Nova Scotia should be the same as in existing markets in Ontario and Quebec. It supported the idea of pricing gas at 65 percent of the price of oil on an energy-equivalent basis. It did not believe that federal subsidies would be required to ensure the success of the project. It submitted that, since natural gas prices would rise with those of oil and since natural gas production costs would increase at a much lower rate than those of oil, the additional revenue generated would more than offset the costs of expanding natural gas markets to eastern Canada. Nova Scotia also believed that the costs of incremental expansion should be rolled into the costs of the whole pipeline system.





LIST OF INTERVENORS  
TO THE CERTIFICATE PHASE

A. ASSOCIATIONS

Canadian Gas Association  
Canadian Petroleum Association  
Independent Petroleum Association of Canada  
Industrial Gas Users Association  
Propane Gas Association of Canada

B. PRODUCING COMPANIES

Amoco Canada Petroleum Company Ltd.  
BP Canada Inc.  
Canadian Superior Oil Ltd.  
Dome Petroleum Limited  
Gulf Canada Limited and Gulf Canada Resources Inc.  
Hudson's Bay Oil and Gas Limited  
Imperial Oil Limited  
Mobil Oil Canada, Ltd.  
Norcen Energy Resources Limited  
PanCanadian Petroleum Limited  
Petro-Canada  
Shell Canada Resources Limited  
Texaco Canada Inc.

C. OTHER COMPANIES

Alberta and Southern Gas Co. Ltd.  
The Alberta Gas Trunk Line Company Limited  
Consolidated Natural Gas Limited  
Dow Chemical of Canada, Limited  
Gaz Inter-Cité Québec Inc.  
Gaz Métropolitain, inc.

Greater Winnipeg Gas Company  
Great Lakes Gas Transmission Company  
ICG Scotia Gas Ltd.  
Intercity Gas Limited and  
Maritime Electric Company Limited  
Michigan Wisconsin Pipe Line Company  
Midwestern Gas Transmission Company  
Niagara Gas Transmission Limited  
Northern and Central Gas Corporation Limited  
Nova Scotia Power Corporation  
Pacific Interstate Transmission Company  
Pan-Alberta Gas Ltd.  
Polar Gas Limited  
ProGas Limited  
Saskatchewan Power Corporation  
Superior Propane Limited  
The Consumers' Gas Company  
Ultramar Canada Limited  
Union Gas Limited  
Wood Energy Consultants Limited

D. OTHER GROUPS

Association des agents de développement  
économique de l'Est du Québec  
Association des commissaires industriels du Québec  
Business and Industrial Development Board  
of Trois-Rivières  
Canadian Arctic Resources Committee  
Conseil de développement de la Haute-Mauricie  
Conseil économique Lévis-Lauzon Inc.

Conseil régional de développement de l'Est du Québec  
Corporation de promotion industrielle de Sept-Iles inc.  
New Brunswick Federation of Agriculture  
Nova Scotia Federation of Agriculture  
Strait of Canso Industrial Development Authority  
Union des Producteurs Agricoles du Québec  
University of New Brunswick

E. Provincial Governments

Attorney-General for British Columbia  
Attorney-General for Manitoba  
Department of Mineral Resources of the  
Government of Saskatchewan  
Government of New Brunswick  
Government of Newfoundland and Labrador  
Minister of Energy for Ontario  
Procureur Général du Québec  
Province of Nova Scotia





CHAPTER 4  
NATURAL GAS REQUIREMENTS

Introduction

In evaluating the Applications by TransCanada to extend natural gas transmission facilities further into Quebec, and by Q & M to extend such facilities into New Brunswick and Nova Scotia, the Board has reviewed in depth the estimates of gas demand in the proposed service areas presented by each Applicant. The Board, in developing its own estimates of the demand for natural gas in the proposed service areas, has also considered the extensive evidence presented by various intervenors to the hearing. It is recognized by the Board that the development of such estimates of gas demand in new markets is a complex and difficult task. In spite of these difficulties, extensive evidence was presented by various interested parties. This evidence was presented not only in the form of forecasting assumptions, methodology, and results, but also in the form of more general evidence, such as that relating to policy matters, and in the form of background information on energy markets in Quebec, New Brunswick, and Nova Scotia.

The Board reviewed the evidence presented at the hearing and performed its own analysis of the potential markets for natural gas in Quebec, New Brunswick and Nova Scotia. This analysis was carried out in the context of its most recent forecast of total energy demand for Canada as a whole. That forecast was published in Appendix C of the Board's Licence Phase Decision.

Also in keeping with its established practices, as well as preparing its forecast of the most likely demand for natural gas in the markets under consideration, the Board examined high and low demand cases. These cases are presented in Tables 4-6 and 4-12. Because of the complexities involved in estimating demand for natural gas in new markets, the high and low cases simply reflect the effects of different levels of economic activity and different energy prices. The Board's high and low cases do not attempt to assess alternatives as to the degree to which natural gas might penetrate the available market. The various economic and price assumptions of the Board are detailed in Appendix C of the Licence Phase Decision (pages 2 to 13).

In the sections relating to natural gas demand in Quebec, repeated reference is made to the "Montreal market" or the "Montreal area" and to "extension markets" or the "extension area". For purposes of this Chapter, the terms "Montreal", "Montreal market", or "Montreal market area" are defined as referring to Gaz Métropolitain's franchise area, i.e., Montreal and environs. The "extension market" or "extension area" are defined to include only those communities that lie outside the Montreal market area as just defined. In this Chapter, the term "Quebec demand" refers only to the sum of gas demand in the Montreal and extension market areas. Accordingly, "Quebec demand" excludes demand in the Hull and Rouyn-Noranda areas. These communities were not included in the estimated provided by TransCanada since they are not relevant to this Application to extend pipeline facilities in Quebec.

This Chapter presents first the evidence of TransCanada and intervenors on natural gas requirements in Quebec markets, followed by views of the Board. Second, natural gas demand in New Brunswick and Nova Scotia is discussed, with Q & M evidence followed by that of the intervenors and the views of the Board.

#### 4.1 TransCanada

##### 4.1.1 Overview

##### 4.1.1.1 Evidence of the Applicant

TransCanada forecast that natural gas demand would develop as follows:

<u>DEMAND FOR NATURAL GAS</u>			
<u>Forecast of TransCanada</u>			
(PJ/Year)			
<u>Year</u>	<u>Montreal</u>	<u>Extension Market</u>	<u>Quebec</u>
1981	102.3	7.8	110.1
1985	131.9	63.5	195.3
1990	213.0	110.5	323.6
2000	315.0	166.3	481.4

TransCanada provided estimates of natural gas demand for the Montreal area and, separately, for 55 specific communities that would be serviced through its proposed new facilities (extension market). It was stated that natural gas service to some of these communities could begin by late 1980. Assuming that extension of natural gas service took place outside of the existing franchise area, as proposed by TransCanada, approximately two-thirds of the province's population would ultimately have access to natural gas.

TransCanada proposed to extend its natural gas delivery system from St-Lazare, near Montreal, along the St. Lawrence river to Trois-Rivières, and then to Quebec City and Lévis-Lauzon; a number of laterals and sublaterals would serve other communities.

TransCanada proposed to provide service to the communities of Trois-Rivières and Quebec City in 1981 and 1982 respectively. TransCanada would also construct four main laterals from its proposed mainline along the St. Lawrence. TransCanada proposed to extend one lateral as far as Thurso and a second one through the Eastern Townships as far as Thetford Mines, with service commencing in 1982. Two years later, TransCanada would construct laterals from Quebec City to provide service to communities as far north as Dolbeau, as far east as Clermont, and as far south as Beauceville.

The assumptions, methodology, and resulting forecast of gas demand are discussed in the following sections of this chapter for the residential, commercial, and industrial market sectors. For purposes of illustration and comparison, tables and graphs are also presented to show TransCanada's forecast in relation to the forecasts submitted by intervenors (Gaz Inter-Cité, Gaz Métropolitain, Gulf) and the forecast of the Board.

TransCanada's estimates of market expansion sales volumes were based upon a number of specific assumptions. These assumptions related to such matters as the relative prices of natural gas and competing fuels, the proportion of newly constructed buildings selecting natural gas to meet new heating loads (henceforth referred to as capture rates),

rates of change-over of existing dwellings from other fuels to gas (henceforth referred to as conversion), average energy use per account, the disposition of surplus fuel oil, etc. The assumptions and accompanying methodology differed depending upon the specific market sector. A basic premise underlying the forecast was that an adequate distribution organization would be in place to develop the market and meet the projected gas demand.

One of TransCanada's major assumptions was in regard to price. It was assumed that in order to achieve any significant market penetration through displacement of other fuels by gas, i.e., conversion, and promotion of the use of gas in new buildings, i.e., capture rates, a price advantage in favour of natural gas was necessary, whether in the form of a specific discount at the burner tip (such as for residential customers), or in the form of partial or full payment of costs of conversion from oil to gas (such as for industrial customers). A price advantage or incentive price would help displace imported oil in eastern Canada with Canadian gas. Incentive pricing would thus help to meet the overall Canadian objectives in this regard.

TransCanada's price assumptions can be briefly summarized as follows:

- (i) In the residential sector and for small commercial customers, the price of gas would either be equal to the price of light fuel oil, or would be 25 percent below the price of electricity, on an efficiency-adjusted basis, whichever is lower.
- (ii) In the large commercial and the small and medium industrial markets, the price of gas would be equal to the price of light fuel oil. (For the large commercial market in the Montreal area, the weighted average price of light and heavy fuel oil would be used.)
- (iii) In the large industrial market, the price of gas would be equal to the heavy fuel oil price.
- (iv) Electricity prices were assumed to increase at a rate of 8 percent per annum.



- (v) Domestic crude oil prices were assumed to reach world oil price levels by 1985. World oil prices, based on 34° OPEC marker crude laid down in Montreal, were assumed to reach \$243.83/m<sup>3</sup> (\$Cdn.) by 1985, \$350.17/m<sup>3</sup> by 1990, and \$651.95/m<sup>3</sup> by the year 2000, in current dollar terms.

TransCanada assumed that conversion costs from oil to gas in the industrial and large commercial markets would be paid on behalf of the customer. It assumed for the purposes of its forecast that residential conversion costs would not be paid on behalf of the consumer. TransCanada acknowledged that distributors might pay some portion of these costs, but noted that this would mean an effective reduction in the price advantage assumed for gas in the residential sector.

Net sales of natural gas for Quebec, including market expansion, but excluding Hull and Rouyn-Noranda, were forecast by TransCanada to reach 195 PJ in 1985, increasing to 323 PJ in 1990, and to 481 PJ in the year 2000. TransCanada's forecast was 18 percent lower than Gaz Métropolitain's forecast for the year 1985, and 27 percent higher than Gaz Métropolitain's forecast for the year 1990.

In the extension area alone, TransCanada estimated net sales of 64 PJ in 1985, increasing to 110 PJ in 1990, and to 166 PJ in the year 2000. TransCanada's forecast for this market was 4 percent lower than Gaz Métropolitain's forecast in 1985 and 33 percent lower than Gaz Inter-Cité's forecast in 1990. Table 4-2 compares TransCanada's, Gaz Métropolitain's, and Gaz Inter-Cité's forecast net sales of natural gas in the extension area by sector.

With regard to total energy demand, excluding transportation, natural gas was forecast by TransCanada to increase its share of Quebec's secondary energy consumption from the 1976 level of about 9 percent to approximately 27 percent by the year 1990. In that year, gas was expected to have a market share of about 19 percent of total residential energy demand, 22 percent of total commercial demand, and 35 percent of total industrial demand.

Table 4-1 summarizes TransCanada's forecast of natural gas demand in Quebec, combining the Montreal and extension markets. (See also Figure 4-1.) It should be noted that this forecast does not represent a total Quebec forecast, as TransCanada's facilities application had not included estimates for the Hull and Rouyn-Noranda areas.

The Quebec forecast discussed above can be split into two components: the extension market, as shown in Table 4-2, and the Montreal market, shown in Table 4-3.

#### 4.1.1.2 Views of Intervenors

Highlights of forecasts presented by intervenors are as follows:

<u>DEMAND FOR NATURAL GAS</u>				
<u>Comparison of Intervenors' Forecasts</u>				
(PJ/Year)				
	<u>Montreal</u>	<u>Extension Market</u>		<u>Quebec</u>
<u>Year</u>	<u>Gaz Métro</u>	<u>Gaz Métro</u>	<u>Gaz Inter-Cité</u>	<u>Gaz Métro</u>
1981	110.2	7.0		117.2
1985	163.3	66.3		229.5
1990	168.8	66.5	166.6 <sup>(1)</sup>	235.1

(1) Tenth year of service forecast.

In addition, while Quebec did not present a forecast as such, it did present certain views as to its expectation of gas market development.

Quebec indicated that it was willing to see further penetration by gas of the Quebec energy market. Quebec stated that as a result of uncertain world oil supply conditions and recently proposed incentive pricing schemes for natural gas, it now regarded the 190 PJ forecast in its White Paper on Energy as a minimum objective for gas sales by 1990. This would have represented 12 percent of total energy demand in Quebec for that year.

Quebec stated that gas penetration should easily reach 264 PJ by 1990, with 60 percent of this volume developing in the industrial sector and 20 percent in each of the residential and commercial sectors. Of the 264 PJ, 158 PJ would represent growth over present volumes, with about half of this increase taking place outside the present Gaz Métropolitain franchise area. Market penetration by gas in Quebec would be induced by a desire for a secure source of energy and by incentive pricing, which would provide for payments to cover conversion costs and which would improve the competitive situation for natural gas. Increases in natural gas sales would result in the displacement of imported oil in the Quebec market.

To encourage gas market expansion, Quebec suggested that the eastern tariff zone be extended and that natural gas be priced at the Toronto reference price, at 100 percent load factor. To facilitate the penetration of gas in Quebec, the Government stated that if the extension were approved, it would remove the eight percent sales tax presently levied on sales of natural gas in residential and commercial markets. With regard to incentive pricing arrangements for natural gas, Quebec indicated that details of an agreement with the Alberta Government had yet to be completed. However, Quebec supported a reduction in the city-gate price of natural gas relative to oil from 85 percent to 65 percent. Quebec believed that such an incentive pricing scheme should be in effect for five years in each community, upon introduction of gas service.

Gaz Inter-Cité provided a forecast of the demand for natural gas in Quebec, based on an extensive market survey of over eighty municipalities in areas presently not served by gas. The survey was conducted in collaboration with SOQUIP, and provided estimates for only the tenth year of service. Natural gas demand was presented for residential, commercial, and industrial sectors, for the following four geographic zones: the Montreal-Quebec axis (including metropolitan Quebec City but excluding Montreal), the Eastern Townships, the

Saguenay-Lac St-Jean region, and the area east of Quebec City. The forecast excluded the present consumption and future expansion of gas use in the Gaz Métropolitain franchise area.

Gaz Métropolitain's forecast was based on its own extensive market survey prepared in conjunction with industrial consultants, Major et Martin Inc., and La Société Technique d'Aménagement Régional Inc. (SOTAR). The forecast of natural gas demand in Quebec was provided separately for the residential, commercial, and industrial sectors, for every year between 1981, which it assumed to be the initial year of expansion, and 1990. These volumes were further subdivided into growth in volumes in the present franchise area and growth in the extension market. In total, 104 individual market surveys were conducted. Gaz Métropolitain's submission showed all projected sales in excess of estimated levels of 1980, as market expansion volumes. In its evidence, Gaz Métropolitain stated that since filing its intervention, another 26 municipalities along TransCanada's route had been examined. It was concluded from these studies that sales of gas in the order of 31 PJ could be generated by 1990, in addition to those forecast in the submission.

Gulf provided demand estimates for each market sector as well as estimates of fuel and losses. Gulf's forecast reflected increased sales due to the extension of gas service in all regions of Quebec, over and above a natural increase in the Montreal area.

Comparisons between the demand forecasts of the intervenors and those of TransCanada and the Board can be found in Tables 4-1 through 4-4.

In comparing the demand forecasts presented by the intervenors, it should be noted that variations between the forecasts are partly because of differences in the assumed service areas. The demand survey of Gaz Métropolitain included 23 urban centres outside its present franchise area, while Gaz Inter-Cité included survey results from over 80 municipalities outside the Gaz Métropolitain area. In addition, Gaz



Inter-Cité included as part of its service area the region east of Quebec City, where demand was projected to be about 13 PJ in the tenth year. This was not part of the service area proposed by TransCanada. The forecast volumes also reflected differences between intervenors in classifications by sector. Gaz Métropolitain, for example, included apartments as part of the residential sector, while Gaz Inter-Cité included them in the commercial sector.

CRDQ and ADEQ did not prepare any gas demand forecasts for their respective areas. However, they did present evidence to the Board as to why the areas of Matane, Matapédia, and Mont-Joli should have natural gas service. The arguments presented related to the economic development of those areas, the economics of a pipeline, and population levels.

CPA and IPAC also presented evidence on the proposed pipeline extension. However, neither association prepared a natural gas demand forecast.

Consumers' stated that it would have had much more confidence in the forecast of sales if the Applicants had filed contracts for these sales. It was the position of Consumers' that no decision should be made in these proceedings until satisfactory gas sales contracts had been filed with the Board.

#### 4.1.1.3 Views of the Board

The Board forecasts that natural gas demand in Quebec would grow as follows:

<u>DEMAND FOR NATURAL GAS</u>			
<u>Forecast of NEB</u>			
(PJ/Year)			
<u>Year</u>	<u>Montreal</u>	<u>Extension Market</u>	<u>Quebec</u>
1981	100.1	6.5	106.6
1985	120.0	55.9	175.9
1990	173.3	84.3	257.6
2000	265.5	132.0	397.3

The Board's forecast of natural gas demand in the proposed extension markets of Quebec, as well as in the current market areas, was developed in the light of the considerable evidence presented by TransCanada and by various intervenors.

In consideration of the evidence presented, the Board is of the opinion that the current 85 percent relationship between the city-gate price of natural gas and the refinery-gate price of crude oil would not allow natural gas the flexibility in price to penetrate new markets in Quebec to any significant degree. In this situation gas would not achieve the minimum sales volumes necessary for successful market expansion.

As a first step towards the development of its own gas demand forecast, the Board made an assessment of TransCanada's forecast by adopting the assumptions regarding relative prices and payment of conversion costs employed by TransCanada for each of the residential, commercial, and industrial sectors. In addition, a methodology similar to that of TransCanada was utilized for forecasting the demand of each market sector. Such an approach allowed the Board to determine the extent to which its forecast differed from that of TransCanada, within the context of its assumptions regarding burner tip price relationships and conversion costs, and also within the context of its methodology.

The Board also examined the feasibility of realizing the price relationships at the burner tip assumed by TransCanada and the payment of conversion costs. The Board finds that these relative prices are generally consistent with the distributors receiving natural gas in the short to medium term at their city gates at a price approximately equal to 65 percent of the refinery-gate price of crude oil at Toronto, on an energy-equivalent basis.

The Board concludes that TransCanada's relative price assumptions are reasonable under conditions of natural gas incentive pricing to promote gas penetration. Therefore the Board has developed its most likely forecast of gas demand based on these relative price assumptions but with its own forecast of absolute price levels. In addition, the Board's forecast reflects differences in assumptions made with respect to other determining factors, such as conversions from

other fuels and the capture rates of new energy demand. Specific details regarding assumptions, forecasting methodologies, and the resultant forecasts of gas demand are provided for each of the residential, commercial and industrial market sectors, in the following sections of this chapter.

The Board assumes that natural gas would be priced competitively with petroleum products in the domestic market and that any surplus of petroleum products in the domestic market would be satisfactorily eliminated.

In preparing its gas demand forecast, the Board has also reviewed each market sector gas forecast in relation to its estimates of total energy demand. Changes in the market share held by natural gas were estimated based on assumed changes in relative burner tip prices and underlying cross-price market share elasticities. The application of the changes in the gas market share to the forecast of total energy demand resulted in independent estimates of market expansion in Quebec. These estimates generally supported the estimated volumes obtained by the Board using a methodology similar to that of TransCanada.

The Board forecasts net sales of natural gas in the Montreal area and in the proposed extension market in Quebec to be 176 PJ in 1985, 258 PJ in 1990 and 397 PJ in the year 2000. In making its forecast, the Board has assumed that natural gas service would be extended to the same communities that TransCanada assumed would receive service. In addition, gas demand in the existing franchised areas of Hull and Rouyn-Noranda has been excluded, since it was not included in the estimates provided as part of the Application by TransCanada.

The Board's forecast is presented by market sector in Table 4-1. (See also Figure 4-1). For the year 2000, the Board's forecast implies that 20 percent of natural gas sales in Quebec would be in the residential market, with 26 percent commercial and 54 percent industrial.

The Board's forecast of combined net sales in the Montreal and market extension areas is about 10 percent lower than that of TransCanada for 1985, and about 20 percent lower in the longer term. Gaz

Métropolitain provided a forecast only to the year 1990, in which year its forecast was about 27 percent lower than that of TransCanada. However, this did not take into account potential sales of about 31 PJ in 1990 for 26 additional communities that were subsequently evaluated by Gaz Métropolitain. Table 4-3 compares the forecasts for the Montreal area, while Table 4-2 compares the forecasts for the extension area only.

In the proposed extension market alone, the Board estimates net sales of 56 PJ in 1985, increasing to 84 PJ in 1990 and 132 PJ in the year 2000. The Board's forecast for this market is 12 percent lower than TransCanada's corresponding forecast in 1985, and 24 percent lower in 1990. Table 4-2 compares the Board's forecast net sales of natural gas in the extension area to the forecasts of TransCanada and intervenors.

With regard to total energy demand in Quebec, excluding the transportation sector, the Board's forecast implies that natural gas will increase its market share from the current level of about 10 percent to 23 percent in 1990 and to 27 percent in the year 2000. This increase in market share represents additional volumes of 73 PJ in 1985, 145 PJ in 1990, and 240 PJ in 2000 over and above the medium base case volumes (without market expansion) presented in Appendix C of the Licence Phase Report. These expansion volumes are shown by sector in Table 4-4. The corresponding estimates of displaced fuel volumes arising as a result of this gas market expansion are provided in Table 4-5. The Board estimates that for the year 2000, 36 PJ of electricity, 54 PJ of light fuel oil, and 140 PJ of heavy fuel oil will be displaced.

#### 4.1.2 Residential Sector

##### 4.1.2.1 Evidence of TransCanada

TransCanada's forecast of demand for natural gas in residential markets in Montreal and extension areas in Quebec is indicated below:



DEMAND FOR NATURAL GAS - RESIDENTIAL SECTORForecast of TransCanada

(PJ/Year)

	<u>Total Montreal</u>	<u>Extension Market</u>	<u>Total Quebec</u> <sup>(1)</sup>
1981	17.9	--	17.9
1985	27.4	4.4	31.8
1990	47.5	13.8	61.3
2000	73.5	29.1	102.6

(1) Including existing Montreal franchise area, excluding Hull and Rouyn-Noranda.

In forecasting the demand for natural gas in residential markets in Quebec, TransCanada employed a components approach. Under this approach, the forecast number of households in the gas service area was split into new and existing households. Natural gas capture rates of new dwellings and conversion rates to gas of existing dwellings were forecast. Then, average use per dwelling was projected taking into account the mix of dwelling types, differences in use by existing and new dwellings, expected reductions in demand resulting from various conservation measures, and regional differences due to weather variations. The multiplication of the forecast number of residential gas customers in existing and new dwellings by the respective estimates of average use per dwelling resulted in the forecast of residential gas demand, with a final adjustment being applied to estimate effective demand.

For the total proposed gas service area in Quebec, population growth was forecast to average 1.2 percent per annum over the period 1976 to 1990 and 0.2 percent from 1990 to 2000. Based on this projection, corresponding household growth was estimated to be 2.3 percent and 0.5 percent per annum respectively.

With regard to interfuel competition in residential markets, TransCanada's gas demand forecast was based on the assumption that the price of natural gas would be equal to the price of light fuel oil, or

would be 25 percent below the price of electricity, on an efficiency adjusted basis, whichever is lower. The price of electricity was assumed to increase at 8 percent per annum. Efficiency adjustments were incorporated, assuming that natural gas furnaces would remain 65 percent efficient through 1984, increasing gradually to 85 percent by 1988. This assumption took into account the current development by the Canadian Gas Research Institute of a high efficiency natural gas furnace. TransCanada indicated that some mechanism would be required to ensure that natural gas prices would be 25 percent below electricity, at least until high efficiency gas furnaces become widely available.

No explicit assumption was made by TransCanada concerning the possible removal of the eight percent sales tax currently applied to both natural gas and electricity in residential markets in Quebec. However, it assumed both electricity and natural gas would be treated equally in this regard. A final assumption relating to interfuel competition was that conversion costs would not be paid on behalf of the customers.

Against this competitive background, TransCanada estimated that the natural gas capture rate of new dwellings would increase to 40 percent by 1986, subsequently remaining at that level. This would be accompanied by a decrease in the electricity capture rate from 75 percent currently, to 50 percent by 1986. These capture rate forecasts reflected the projected increase from 15 percent to 25 percent in the price advantage of natural gas to electricity, and assumed that the householder's perception of his comparative heating costs would change, as the same insulation standards were adopted, regardless of the heat source, for all new houses.

Since TransCanada assumed that no residential conversion costs would be paid on behalf of the customers, no conversions to natural gas were assumed to occur before furnaces were ready for replacement. The annual potential replacement market was estimated by applying the forecast six percent per annum rate of retirement of furnaces to the

conversion base. This base consisted of all 1971 housing stock remaining after demolition, including some electrically heated dwellings. Natural gas was estimated to capture 40 percent of this annual replacement potential in the first year of residential service, and 60 percent of the annual replacement potential in subsequent years, with a slight variation in the Montreal market. The balance of the replacement potential was projected to stay with oil or electricity. Natural gas was forecast to have an advantage in the replacement market because there would be an increasing emphasis on security of supply, there would be an opportunity to remove the oil storage tank, and because natural gas has inherent advantages over oil, such as its clean burning characteristics. Moreover, conversions from oil to electricity were assumed to be few because of high conversion costs and the possibility of additional insulation requirements.

Separate estimates of average use of natural gas per dwelling, for both existing and new dwellings, were derived for each community, taking into account the use in single family dwellings, apartments and cold flats. Allowing for the mix of dwellings, TransCanada forecast average use in existing and new dwellings for Montreal and Quebec City as indicated below.

AVERAGE USE OF NATURAL GAS PER DWELLING

Estimate of TransCanada

(GJ/Year)

<u>Year</u>	<u>Montreal</u>		<u>Quebec City</u>	
	<u>Existing</u>	<u>New</u>	<u>Existing</u>	<u>New</u>
1978	128	109	146	136
1985	113	102	130	125
1990	105	96	119	119
2000	98	90	112	113

A 23 percent decline in average use in existing dwellings, and a 17 percent decline in use in new dwellings, were projected over the

1978 to 2000 period based on retrofitting of existing dwellings, and assuming improved efficiencies of natural gas furnaces and appliances. The assumed efficiency improvements of one percent per year from 1975 to a maximum of 20 percent by 1995, did not fully take into account the increase in furnace efficiency from 65 percent to 85 percent that had been utilized in determining the retail price of natural gas. However, TransCanada indicated that its forecast would have been reduced only slightly had this latter efficiency been fully incorporated.

Based on the above methodology and assumptions, TransCanada projected that the residential demand for natural gas in Montreal and extension markets in Quebec would reach some 32 PJ in 1985, and 61 PJ in 1990 (Table 4-1).

As a result of the increased residential demand for natural gas associated with the expansion of gas service in Quebec, TransCanada estimated that total electricity demand in Quebec would be lower by 20 PJ in 1990, and by 40 PJ in the year 2000, than otherwise would be the case in the absence of gas expansion. It was also indicated that the demand for light fuel oil would decrease significantly as a result of the expansion of the gas service area in Quebec, although no specific estimates were provided.

A major assumption underlying TransCanada's residential gas demand forecast was that the distributor would not pay conversion costs for customers. However, TransCanada recognized that in practice the distributor might pay some portion of these conversion costs. TransCanada also recognized that in practice the distributor might provide assistance to builders of new dwellings by paying the additional cost associated with installing natural gas heating equipment in new dwellings, compared with installing electric heating equipment. Such action would probably lead to a reduction in the 25 percent gas price advantage over electricity, resulting in a reduced gas capture rate of new dwellings but at the same time increasing the conversion rate of existing dwellings. TransCanada expected that these two factors would offset each other, and would not result in any change in its forecast of natural gas demand in the residential sector.



#### 4.1.2.2 Views of Intervenors

The Government of Quebec did not provide a specific forecast of gas demand in the residential sector. It did, however, indicate its expectations with regard to certain factors which would affect the ability of gas to penetrate residential markets. Quebec stated that it expected the capture rate of new dwellings by electricity, currently of the order of 75 percent, to remain constant in the near future, perhaps declining towards the end of the 1980's. Such continued penetration by electricity would, however, depend on the price of natural gas relative to other energy forms. Quebec stated it was not its intention to intervene in the market in favour of electricity.

Quebec expected the largest part of the demand for natural gas to result from the conversion of existing dwellings presently using oil. Such conversion could be accelerated under a gas incentive pricing scheme, which would allow 75 to 100 percent of conversion costs to be paid on behalf of the customer. Although Quebec indicated that gas would be the most economical choice in the conversion market, conversion to electricity was indicated to be a very strong alternative that was unlikely to diminish rapidly.

Specific forecasts of residential demand for natural gas were submitted by Gaz Inter-Cité, Gaz Métropolitain and Gulf.

The following table presents highlights of these forecasts:

#### DEMAND FOR NATURAL GAS - RESIDENTIAL SECTOR

##### Comparison of Intervenors' Forecasts

<u>Year</u>	<u>Montreal</u>	<u>Extension Market</u>		<u>Quebec</u>
	<u>Gaz Métro</u>	<u>Gaz Métro</u>	<u>Gaz Inter-Cité</u>	<u>Gaz Métro</u>
1981	18.4	0.4		18.8
1985	36.0	7.2		43.1
1990	40.6	10.8	27.6 <sup>(1)</sup>	51.4

(1) Tenth year of service forecast

The forecast of Gulf is not included in the table since it estimated only the increase in natural gas demand due to incentive pricing and only for

all regions of Quebec. Gaz Inter-Cité provided an estimate of the demand for natural gas in the extension market of 27.6 PJ in the tenth year of service. In the extension market, Gaz Métropolitain estimated that demand for natural gas in the residential sector would rise from .374 PJ in 1981 to 7.14 PJ by 1985 and to 10.787 PJ by 1990. Growth in residential demand for natural gas in the Montreal area, compared with the 1980 forecast of residential demand of 17.057 PJ, was forecast to be higher by 18.924 PJ by 1985 and 23.547 PJ by 1990.

Gaz Métropolitain estimated that residential demand for natural gas in Quebec, excluding Hull and Rouyn-Noranda, would increase from 18.763 PJ in 1981 to 43.123 PJ by 1985 and to 51.39 PJ by 1990.

Gulf estimated the increase in natural gas demand in the residential sector due to incentive pricing in all regions of Quebec to be 15.8 PJ in 1985, 21.5 PJ in 1990 and 27.7 PJ in the year 2000.

It should be noted, however, that the volumes forecast by the various intervenors are not strictly comparable. Gaz Métropolitain, for example, included apartments in its definition of the residential sector while Gaz Inter-Cité did not. The proposed market area in Gaz Inter-Cité's forecast was considerably larger than that indicated by Gaz Métropolitain, and the residential estimates of Gaz Inter-Cité included a volume of 2.32 PJ for the area east of Quebec City, which was not part of TCPL's proposed service area.

Gaz Inter-Cité expected natural gas to capture 15 percent of new structures in the initial year of service, increasing by 5 percent per year, to reach a maximum of 35 percent per year in the fifth year. Conversion of existing residential structures was assumed to increase from 10 percent of the replacement potential in the initial year of service to 75 percent per year of annual replacement potential by the sixth year of service, remaining constant thereafter. Gaz Métropolitain assumed a constant 30 percent per year capture rate of new structures in the residential sector throughout the forecast period. The conversion of existing structures was assumed to increase from 4 percent of potentially convertible structures in the initial year of service to 22 percent per year by the fifth year and to 27 percent per year by the tenth year.

Gulf estimated that of the new residential structures built in Quebec, gas would capture 35 percent in 1981, increasing to 50 percent per year by the year 2000. Furthermore, Gulf assumed that five percent of the residential furnace stock would be replaced annually, and that 50 percent of these replacement furnaces would be converted to gas.

Both Gaz Inter-Cité and Gaz Métropolitain stated that in order to ensure penetration of natural gas in the residential market in Quebec, gas would have to be priced ten percent below the price of competitive energy prices for at least a ten-year period. Gaz Métropolitain indicated, however, that this advantage for natural gas would be required over oil in the first five years, and over electricity subsequently, as the competitive situation changed. In its intervention, Gulf stated that, in its view, gas would need a discount of 20 percent relative to alternative fuels. In addition, conversion cost assistance was assumed by all these intervenors. Gaz Métropolitain proposed that 100 percent of the costs of conversion be paid on behalf of the consumer; Gaz Inter-Cité suggested that 75 percent of these costs be defrayed while Gulf foresaw a need for a sufficient incentive of this kind as necessary.

Gaz Métropolitain's forecast of natural gas demand was reduced by 0.9 percent in the initial year of service, increasing to 16.8 percent by the tenth year of service, to account for increased conservation efforts on the part of consumers. Gulf indicated that, in general, conservation was expected to reduce consumption by 15 percent while a higher proportion of single dwellings relative to apartments in the expansion market would tend to increase consumption by 7.0 percent, resulting in a net reduction of 8 percent.

#### 4.1.2.3 Views of the Board

The demand for natural gas in residential markets in Montreal and in proposed extension markets in Quebec is forecast by the Board using TransCanada's relative price assumptions and its assumption that no conversion costs would be paid for on behalf of the customer. The Board's forecast is presented below, in comparison with that of TransCanada.

DEMAND FOR NATURAL GAS - RESIDENTIAL SECTORComparison of Forecasts

(PJ/Year)

	<u>Montreal</u>		<u>Extension Market</u>		<u>Quebec</u> <sup>(1)</sup>	
	<u>NEB</u>	<u>TCPL</u>	<u>NEB</u>	<u>TCPL</u>	<u>NEB</u>	<u>TCPL</u>
1981	20.0	17.9	--	--	20.0	17.9
1985	30.3	27.4	6.4	4.4	36.7	31.8
1990	40.9	47.5	15.0	13.8	55.9	61.3
1995	49.4	61.2	21.9	21.7	71.3	82.9
2000	51.8	73.5	26.3	29.1	78.0	102.6

(1) excluding Hull and Rouyn-Noranda.

The Board's forecast of residential demand for natural gas is slightly higher than that of TransCanada in the initial part of the forecast period in both the Montreal and extension markets in Quebec. By 1990, however, the Board's estimate of Quebec demand is nine per cent lower than TransCanada's, with more significant differences occurring by the end of the forecast period. In both the Montreal and extension markets, it is the Board's lower estimate of the number of residential conversion customers which leads to a lower forecast of gas demand in residential markets after 1985. In the extension market, however, the Board's forecast demand does not drop below that of TransCanada until after 1995, mainly as a result of the Board's higher estimate of average use of natural gas per dwelling.

The assumptions underlying the Board's forecast of demand for natural gas in residential markets in Quebec are discussed below, together with further details of the results.

The estimated number of households in Quebec is based on the latest Statistics Canada population projections which utilize census data



to 1976. The regional distribution of households in Canada incorporates patterns of interprovincial migration which reflect an increasing shift westward. Relative to the projections developed by Statistics Canada, the Board's assumed distribution represents an intermediate pattern for Quebec. The resulting number of households in Quebec is projected to grow at an average annual rate of 1.8 percent over the period 1976 to 1990, and 0.5 percent subsequently. The rate of increase is very close to that projected in the white paper on energy policy by the Government of Quebec. The proportion of households in the proposed natural gas service area in Quebec is estimated to increase from 73 percent in 1976 to 78 percent by the year 2000. This results in household growth within the proposed service area of 2.1 percent per annum to 1990 and 0.7 percent from 1990 to 2000. This growth is only slightly lower than that of TransCanada in the period to 1990, and only slightly higher subsequently.

In the new housing market in Quebec, electricity is currently penetrating very well, capturing in the order of 75 percent of all new dwellings constructed. However, under TransCanada's assumptions that natural gas will be priced 25 percent below electricity on an efficiency adjusted basis, the Board expects that natural gas would be able to make significant inroads into this market. Hence the Board has adopted TransCanada's assumed annual rate of gas capture of 30 percent of new dwellings in the period to 1985, and 40 percent subsequently, for its forecast. This penetration by gas in new residential markets appears to represent an intermediate situation with regard to both the underlying competitive position of natural gas relative to electricity and the corresponding capture rate in Quebec and Ontario currently. Viewed in this context, the capture rate assumed by TransCanada appears reasonable to the Board under the assumed price discount.

In residential conversion markets, the Board has assumed that the conversion base consists of existing oil heated dwellings only, since

very few conversions from electricity to gas are likely to occur. This base of an estimated 866,000 dwellings is approximately eight percent lower than that of TransCanada in 1980, with the difference being mainly attributable to the exclusion by the Board of electrically heated dwellings. The conversion base of oil heated dwellings has also been adjusted by the Board to correct for a significant overestimation of the number of single attached dwellings in large urban centres in Quebec in the 1971 Census data. The Census indicated that in Montreal, for example, the number of single attached dwellings was overstated at the expense of the apartment category, which was underestimated by 36 percent. Hence, the Board's forecast conversion base has significantly fewer single dwellings than that of TransCanada, with 19 percent fewer singles in the Montreal area alone.

With regard to penetration by natural gas of the conversion base of existing oil heated dwellings, the Board has considered only the furnace replacement market as the potential for conversion, under TransCanada's assumption that no residential conversion costs would be paid for. Hence, the Board assumes that no conversions to natural gas will occur before a furnace is worn out. Of the six percent of furnaces estimated to be retired each year in Quebec, the Board assumes that 40 percent would install natural gas in the first year of service, followed by 50 percent subsequently in the period to 1990, and 55 percent from 1990 to 2000. This compares with 60 percent gas penetration in the replacement market assumed by TransCanada after the initial year of service, although it assumed 40 percent in the initial year. The Board assumes that natural gas will be competing with both oil, a traditional energy source in Quebec, and electricity, which is also a secure source of energy. Although in the Board's forecast natural gas is given the edge over each of the competing energy sources, TransCanada's 60 percent annual rate of gas penetration of the potential conversion market was considered to be too optimistic, particularly in the early years when the current strong conversion to electricity in Quebec, in the order of

20,000 dwellings a year, is expected to continue. Such conversion is expected to be undeterred, at least in the short run, by the need to install additional insulation when converting to electricity, because these costs are largely offset by federal and provincial conservation programs. No further conversions to natural gas are assumed to occur 17 years after the initiation of natural gas service, since all furnaces are assumed to have come up for replacement within this time frame.

Under the above assumptions, the total number of conversion customers is predicted by the Board to increase slowly to 240,000 in 1990, reaching 434,000 in 1998, and remaining constant thereafter, in the Montreal and extension markets in Quebec. Taking both conversion customers and new customers into account, natural gas is projected to be used in 28 percent of all service area households by 1990, and 40 percent by the year 2000.

In projecting average use of natural gas per dwelling in the Montreal and extension markets, the Board has utilized the evidence presented by Gaz Métropolitain on current use of natural gas in single dwellings, duplexes and apartments. This data has been adjusted to take into account the projected mix of dwellings, differences in degree days between Montreal and extension markets, and expected reductions as a result of conservation. The resulting average use per dwelling is indicated below.

AVERAGE USE OF NATURAL GAS PER DWELLING

NEB Estimate

(GJ/Year)

<u>Year</u>	<u>Montreal</u>	<u>Quebec Extension Market</u>
1981	117	--
1985	114	142
1990	108	131
2000	93	111

The above estimates take into account the proportion of the housing stock consisting of single dwellings which is projected to increase in the total gas service area from 34 percent, based on data for 1976, to 37 percent in 2000. With regard to conservation, an additional 12 percent saving per dwelling over the period 1978 to 2000, occurring as a result of additional insulation in existing and new dwellings as well as other conservation measures, is projected. Moreover, The Board's forecast assumes a 20 percent increase in the efficiency of furnaces and gas appliances during the period 1978 to 2000. This compares with an increase of 17 percent used by TransCanada over the same period. The Board's higher estimate allows for a greater increase in furnace efficiency, which is consistent with the introduction of high efficiency natural gas furnaces. The Board projects an overall reduction in average use per dwelling of 30 percent by the year 2000 as a result of these conservation measures. TransCanada over the same period incorporated conservation savings of 23 percent in existing dwellings, and 17 percent in new. The Board's overall conservation estimate is similar to that foreseen by the Government of Quebec in its white paper on energy, and also by Gaz Métropolitain to the year 1990. Taking all factors into consideration, however, the Board's estimated average annual use per dwelling does not differ significantly from that of TransCanada, since different assumptions regarding the mix of dwellings and average annual use by type of dwelling offset each other.

The resulting Board forecast of demand for natural gas in residential markets in Montreal and extension markets in Quebec is compared with those of TransCanada and intervenors in Table 4-1. As indicated previously, the Board's forecast for residential gas demand in Quebec is somewhat higher than that of TransCanada in the first few years of gas market expansion, but is lower than that of Gaz Métropolitain. Subsequently, the reverse is true, with the Board's forecast demand decreasing relative to TransCanada's, mainly as a result of an estimated fewer conversion customers. It is believed that Gaz Métropolitain's forecast is higher than that of the Board in the



initial years as a result of a faster rate of penetration of the conversion base, under the assumption that conversion costs would be paid for.

Viewed in the context of total energy demand, the Board's current forecast demand for natural gas in residential markets in Quebec implies an increase in the market share held by natural gas from 6.8 percent currently to 17.7 percent in 1990, and 20.7 percent by the year 2000.

With regard to displacement of other energy forms in the residential sector, the Board estimates that in the order of 50 percent of gas expansion would be at the expense of electricity, and 50 percent at the expense of light fuel oil. This implies a displacement of 21 PJ of electricity and about 25 PJ of light fuel oil in the year 2000.

The Board also recognizes that the distributor may make some contribution towards the cost of converting residential customers' furnaces to use natural gas, contrary to the assumption underlying the Board's forecast, thereby increasing the conversion rate of existing dwellings. At the same time this would presumably result in a reduction in the burner tip price advantage for natural gas of 25 percent over electricity, resulting in a drop in the capture rate of new dwellings by gas. Under such circumstances, the Board expects that the decrease in gas demand resulting from a reduced gas capture rate of new dwellings could be largely offset by a faster rate of gas penetration of the conversion market in the short to medium term.

#### 4.1.3 Commercial Sector

##### 4.1.3.1 Evidence of TransCanada

TransCanada estimated commercial demand for natural gas separately for existing and expansion markets in Quebec.

The following table summarizes its forecast:

#### DEMAND FOR NATURAL GAS - COMMERCIAL SECTOR

##### Forecast of TransCanada

(PJ/Year)

<u>Year</u>	<u>Montreal</u>	<u>Extension Market</u>	<u>Quebec</u>
1981	14.8	--	14.8
1985	24.3	3.9	28.2
1990	45.3	7.4	52.7
2000	59.1	13.5	72.6

As a basis for estimating the size of the commercial market in the Montreal area that could be converted to natural gas, TransCanada used the amount of oil currently being consumed. TransCanada assumed there would be no conversions from electricity to natural gas.

Conversion rates with respect to the replacement market were the same as those assumed for the residential sector, namely, 20 percent in 1981, 40 percent from 1982 to 1984, and 60 percent thereafter.

Capture rates applied to incremental commercial energy demand in Montreal were also identical with those used for the residential sector, namely, 15 percent in 1981, 20 percent in 1982, 30 percent from 1983 to 1985 and 40 percent thereafter.

Based on information received from Gaz Métropolitain, TransCanada estimated that total commercial consumption consisted of 55 percent small customer usage and 45 percent large customer usage.

TransCanada estimated the demand for natural gas in the commercial sector in Montreal to increase from 14.8 PJ in 1981 to 45.3 PJ in 1990 and to 59.1 PJ in 2000. The market share of natural gas in the commercial sector in Montreal was estimated to increase from 11.1 percent in 1981 to 28.9 percent in 1990 and to 36.6 percent in the year 2000. The market share of petroleum products was forecast to decline from 45.4 percent in 1981 to 24.1 percent in 1990 and to 16.1 percent in 2000.

In the extension market area TransCanada estimated natural gas demand in the commercial sector in each community by using the ratio of per capita retail trade in the community to per capita retail trade in Quebec as a whole. TransCanada also used the 1976 ratio of commercial to residential energy consumption. These ratios were used to calculate a first estimate of total commercial gas consumption in each community, based on the forecast of residential gas consumption in that community. This methodology assumed gas capture and conversion rates being identical with those used for the residential sector.

A preliminary estimate of consumption of natural gas by large commercial customers was made by Lalonde, Girouard, Letendre and

Associates (LGL and Associates). Two subsequent refinements were made. First, each community's estimated total commercial demand was adjusted to conform with total provincial commercial consumption. Secondly, an updated estimate, by LGL and Associates, of potential demand by large commercial customers for each community was substituted for the preliminary one.

With regard to interfuel competition, TransCanada had excluded heavy fuel oil used by large commercial establishments from its estimates of substitutable commercial energy demand in the extension market area. Estimates of gas substitution for heavy fuel oil in these large commercial establishments were included in the industrial sector.

With regard to price, TransCanada had assumed for the small commercial market, as for the residential sector, that the price of gas would be equal to the price of light fuel oil, or would be 25 percent below the price of electricity, whichever is lower.

For the large commercial market, the price of natural gas was assumed to be at parity with the price of the relevant competing fuel oil and conversion costs were assumed to be paid on behalf of the customer.

TransCanada projected that market expansion gas sales in the commercial sector would reach approximately 10 PJ in 1985, and approximately 34 PJ in 1990. Including the existing Montreal market, total sales were projected to reach about 28 PJ in 1985, and 53 PJ in 1990.

For the extension market outside Montreal, TransCanada estimated demand in the commercial sector to increase from 3.9 PJ in 1985 to 7.4 PJ in 1990.

#### 4.1.3.2. Views of Intervenors

The forecasts of commercial demand for natural gas presented by Gaz Inter-Cité, Gaz Métropolitain and Gulf exhibited considerable variation.

These differences are apparent in the following table:

DEMAND FOR NATURAL GAS - COMMERCIAL SECTORComparison of Intervenors' Forecasts

(PJ/Year)

<u>Year</u>	<u>Montreal</u>	<u>Extension Market</u>		<u>Quebec</u>
	<u>Gaz Métro</u>	<u>Gaz Métro</u>	<u>Gaz Inter-Cité</u>	<u>Gaz Métro</u>
1981	18.6	0.8		19.4
1985	30.9	7.2		38.1
1990	32.5	7.6	45.8 <sup>(1)</sup>	40.0

(1) Tenth year of service forecast.

The forecast of Gulf is not included in the table since it estimated only the increase in natural gas demand due to incentive pricing and only for all regions of Quebec.

Gaz Inter-Cité estimated commercial demand for natural gas, in the extension market, of 45.77 PJ for the tenth year of gas service. Gaz Métropolitain predicted demand for natural gas in the Quebec extension market to be 7.14 PJ in 1985 and 7.55 PJ in 1990. Growth in natural gas demand in the commercial sector for the Montreal area was forecast by Gaz Métropolitain to be higher by 14.65 PJ in 1985 and by 16.16 PJ in 1990 than its estimated 1980 commercial demand of 16.28 PJ. For Quebec, excluding Hull and Rouyn-Noranda, demand for natural gas in the commercial sector was forecast to increase from 19.42 PJ in 1981 to 38.08 PJ by 1985 and to 40.00 PJ by 1990. Gulf estimated gas market expansion in Montreal and in the extension market in the commercial sector to increase from 10.4 PJ in 1985 to 15.8 PJ by 1990 and finally to 22.7 PJ by 2000 (Table 4-4).

The diversity of results was caused not only by the differences in basic assumptions such as relative prices, conversion costs and penetration rates, but also by the variations in methodologies, and by-sector classifications employed by each intervenor. Gaz Inter-Cité for example, defined apartments as part of the commercial sector, while Gaz Métropolitain included apartments as part of the residential sector. In addition, Gaz Inter-Cité included considerably more urban centres



in its market area than did Gaz Métropolitain. Such considerations make it difficult to make direct comparisons.

Gaz Inter-Cité indicated that institutional structures would experience very high conversion rates increasing from 50 percent in the initial year of service to 100 percent in the third year of service. This reflected Gaz Inter-Cité's assumption that governments would show their support by converting all government buildings to natural gas. Conversion of the existing stock of commercial establishments showed an increase from 15 percent in the initial year of service to 85 percent by the sixth year, remaining constant thereafter. Natural gas was projected to capture 20 percent of new commercial structures in the initial year of service, increasing to 30 percent by the third year.

Gaz Métropolitain assumed the rate at which large institutional structures would be converted to natural gas would reach 80 percent after the second year of service and would remain constant thereafter. The conversion rates for existing, small institutional and commercial structures were forecast to increase from 10 percent in the initial year of service to a maximum of 55 percent by the tenth year. The capture rate of new commercial structures by natural gas was assumed to be 60 percent throughout the forecast period.

In the commercial sector forecast provided by Gulf, a total energy demand concept was used. It was assumed that market expansion would make gas available to 85 percent of the commercial customers in the province. This increased coverage, coupled with the competitive price assumption, discussed in the next paragraph, resulted in increasing Gulf's forecast of the natural gas share of the commercial energy market from 7 percent in 1975 to 20 percent by 2000, with both light and heavy fuel oil being displaced.

Gaz Inter-Cité stated that in order to ensure penetration of the commercial market by natural gas a ten percent discount in the price of natural gas relative to other fuels was necessary. It maintained that incentive pricing should be in force for a period of ten years with no

phase-out period. Gaz Inter-Cité maintained that 75 percent of conversion costs would need to be paid on behalf of consumers to achieve the projected market penetration. Gaz Métropolitain suggested as a general criterion that natural gas be priced equal to alternative fuels, on an energy equivalent basis, but that 100 percent of conversion costs be paid on behalf of consumers. Gulf stated that a 20 percent discount would be necessary in the small commercial market; and that price equivalence with alternative fuels on an energy equivalent basis would be sufficient in the large commercial market if sufficient incentives were offered to cover capital costs of conversion.

Conservation was forecast by Gaz Métropolitain to reduce the demand for natural gas by 2.2 percent in the initial year of service, rising to 16 percent by the tenth year.

#### 4.1.3.3 Views of the Board

The Board, broadly following the method of TransCanada, prepared separate forecasts of demand for natural gas for the Montreal and extension market areas, in the context of total commercial demand for energy by fuel type. The forecast of energy demand was combined with estimates of rates of conversion from oil to natural gas and capture rates in incremental energy markets, using TCPL's assumptions regarding pricing of natural gas and payment of conversion costs, to yield the Board's estimates of demand for natural gas in the commercial sector.

The Board's forecast of demand for natural gas in the commercial sector is compared with that of TransCanada in the following table. The table shows that for the year 1990, the Board's forecast is close to that of TransCanada, but considerably higher thereafter.

#### DEMAND FOR NATURAL GAS - COMMERCIAL SECTOR

##### Comparison of Forecasts

(PJ/Year)

<u>Year</u>	<u>Montreal</u>		<u>Extension Market</u>		<u>Quebec</u>	
	<u>NEB</u>	<u>TCPL</u>	<u>NEB</u>	<u>TCPL</u>	<u>NEB</u>	<u>TCPL</u>
1981	16.8	14.8	--	---	16.8	14.8
1985	21.9	24.3	3.3	3.9	25.2	28.2
1990	42.5	45.3	9.2	7.4	51.7	52.7
2000	84.2	59.1	20.4	13.5	104.5	72.6

The estimated commercial sector demand for energy in Montreal is based on an estimate of total commercial demand for energy for Quebec as a whole. In estimating the proportion of provincial commercial demand for energy represented by the Montreal Market, it is believed that the proportion of provincial population residing in the market area cannot be used as an indicator of the area's share of commercial energy demand in the provincial total. Data collected for the Census of 1971 show that the proportion of provincial population residing in an urban centre does not necessarily reflect the share of the centre in the province's total value of retail trade. According to the Census, while Montreal accounted for 36 percent of the population of Quebec, its share of total provincial value of retail trade was higher at 40 percent. Also, according to Quebec's White Paper on Energy Policy, Gaz Métropolitain's franchise area, which covers Montreal and vicinity, includes 55 percent of retail businesses in Quebec. Commercial activities tend to be concentrated in large urban centres and hence, commercial energy consumption in a metropolitan centre tends to be out of proportion to its population.

Based on an analysis of these factors, the Board estimates the Montreal proportion of total provincial commercial energy demand to be 59 percent in 1981. As the historical trend towards concentration of population in Montreal and vicinity would probably continue in the short to medium term, and also, as a major part of the future commercial sector growth can reasonably be expected to occur in the Montreal market, the Board estimates the proportion of commercial energy demand in the Montreal area to increase gradually from 59 percent of the provincial total in 1981 to 65 percent in 2000.

The Board's estimates of proportions of commercial energy demand in Quebec attributable to the Montreal market appear reasonably consistent with such estimates implicit in TransCanada's evidence. The evidence implies that TransCanada estimated the proportion of commercial energy demand in the Montreal area to be 58 percent of the provincial total in 1985 and 62 percent in 1990.

As regards conversion in the Montreal market, light and heavy fuel oil demand as estimated for 1980 will form the basis for conversion from oil to gas. Assuming an average oil furnace life of twenty years, approximately five percent of furnaces, representing about five percent of the demand for those petroleum products (at the beginning of gas expansion), are estimated to be available for conversion during each year of the forecast period. By the end of the twentieth year, all furnaces are expected to have come up for replacement. Conversion rates employed by the Board are the same as those used by TransCanada. Conversion is assumed to be 20 percent of the furnaces available for conversion in the first year of service, increasing to 60 percent in 1985 and remaining constant thereafter.

The Board's assumptions regarding capture rates in the Montreal market take into account separately the ability of natural gas to compete with oil products and with electricity for new commercial demand. In this regard, a gas capture rate at the expense of oil products is projected at 20 percent in 1981, increasing to 60 percent by 1985. In competition with electricity, natural gas is assumed to capture 4.5 percent of new commercial electricity demand in 1981, increasing to 12 percent by 1986. The effective rate of capture assumes that 30 percent of incremental electricity demand is substitutable, with gas capture of the substitutable demand increasing from 15 percent in 1981 to 40 percent by 1986.

The Board estimates that the commercial sector market share of gas in Montreal will increase from about 13 percent in 1981 to 27 percent in 1990 and 32 percent in 2000. In comparison, TransCanada estimated this market share of gas to increase from 11 percent in 1981 to 29 percent in 1990 and about 37 percent in 2000.

The Board uses the same methodology in forecasting commercial demand for natural gas for the extension market as for the Montreal market. Like TransCanada, the Board applies the same capture and conversion rates to the extension market as those assumed for Montreal.



Unlike TransCanada, however, the Board includes heavy fuel oil used by large commercial establishments in its estimate of substitutable energy demand in the extension market. As in the case of the Montreal market, conservation is assumed to reduce demand for natural gas in the extension market by 20 percent in the year 2000.

For the extension market, the Board estimates demand for natural gas in the commercial sector to increase from 3.3 PJ in 1985 to 9.2 PJ in 1990 and to 20.4 PJ in the year 2000. In comparison, TransCanada estimated demand in the extension market to increase from 3.9 PJ in 1985 to 7.4 PJ in 1990 and to 13.5 PJ in 2000.

The Board forecasts demand for natural gas in the commercial sector in the Montreal and extension markets in Quebec to increase from about 17 PJ in 1981 to 52 PJ in 1990 and 105 PJ in 2000. This represents an increase in the market share of gas in the commercial sector in Quebec from 9 percent in 1981 to 22 percent in 1990 and to 27 percent in 2000. At the same time, the market share of petroleum products is forecast to decline from 48 percent in 1981 to 31 percent in 1990 and to 16 percent in 2000. With regard to fuels displaced in the commercial sector by natural gas, the Board assumes that, whereas such expansion would take place mainly at the expense of petroleum products, the proportion of electricity in fuels displaced will gradually increase, reflecting the difficulty of further displacing rapidly declining petroleum product demand. Thus, the proportion of petroleum products in fuels displaced by gas is estimated to decline from 93 percent in 1985 to 90 percent in 1990 and to 77 percent in 2000.

#### 4.1.4 Industrial Sector

##### 4.1.4.1 Evidence of TransCanada

TransCanada projected that total sales of natural gas in the industrial sector would be as follows:

#### DEMAND FOR NATURAL GAS - INDUSTRIAL SECTOR

##### Forecast of TransCanada

(PJ/Year)

<u>Year</u>	<u>Montreal</u>	<u>Extension Market</u>	<u>Quebec</u>
1981	69.6	7.8	77.4
1985	80.2	55.2	135.3
1990	120.2	89.3	209.6
2000	182.4	123.7	306.2

TransCanada forecast a rapid increase in the industrial demand for gas based on a number of underlying assumptions.

With regard to economic assumptions used in forecasting industrial energy demand, TransCanada based its assessment on estimates of future growth in gross domestic product of the manufacturing sector in Quebec.

The underlying price assumptions were as follows:

- (a) The industrial price of natural gas would be at parity with prices of alternative fuels. For small and medium-size industrial accounts, this implied price parity with light fuel oil; for large industrials, it implied price parity with heavy fuel oil.
- (b) Conversion costs from oil to gas would be paid for on behalf of the customer.

Although gas was assumed to be priced no cheaper than heavy fuel oil, industrial customers were assumed to convert to natural gas because of security of supply considerations and the non-pollutant qualities associated with gas.

As with the other sectors, the industrial demand for gas was forecast separately for the Montreal and the market extension areas. Total industrial energy demand in the Montreal area was forecast to increase at an average annual growth rate of 3.3 percent after taking into account the effects of energy conservation.

For the Montreal area, about one-third of the growth in total industrial energy demand was assumed to be non-substitutable electricity demand. The remainder was considered as potential substitutable energy. TransCanada assumed that, by the third year of the forecast for the Montreal area, about 75 percent of the increase in substitutable energy demand and 75 percent of the available demand in the potential conversion market in the industrial sector would be captured by natural gas.

In the extension area, total industrial energy demand was forecast to increase at an average annual growth rate of 1.5 percent

from 1981 to 1985, and at 2.0 percent thereafter. These growth rates were net of the effects of conservation. For this area, TransCanada also included in the industrial sector the gas demand of large commercial establishments switching from heavy fuel oil. However, similar demands for natural gas in the Montreal area were included in the commercial sector.

In the market extension area, natural gas was expected to capture 75 percent of the potential substitutable energy demand of the small industrial market by the fifth year of service. Ultimately, the entire medium industrial market was expected to be captured by natural gas. In the large industrial market, natural gas was assumed to capture only that part of the demand that would not be met by the heavy fuel oil output of eastern Canadian refineries, which was forecast to decline over the period.

#### 4.1.4.2 Views of Intervenors

Forecasts of natural gas demand in the industrial sector were provided by Gaz Inter-Cité, Gaz Métropolitain and Gulf.

The following table highlights these forecasts:

#### DEMAND FOR NATURAL GAS - INDUSTRIAL SECTOR

##### Comparison of Intervenors' Forecasts

(PJ/Year)

<u>Year</u>	<u>Montreal</u>	<u>Extension Market</u>		<u>Quebec</u>
	<u>Gaz Métro</u>	<u>Gaz Métro</u>	<u>Gaz Inter-Cité</u>	<u>Gaz Métro</u>
1981	73.2	5.8		79.0
1985	96.4	51.9		148.3
1990	95.7	48.1	93.2 <sup>(1)</sup>	143.7

(1) Tenth year of service.

The forecast of Gulf is not included in the table since it estimated only the increase in natural gas demand due to incentive pricing and only for all regions of Quebec.

Gaz Inter-Cité forecast that the industrial demand for natural gas in the market extension area would reach 93.2 PJ in the tenth year of service. Gaz Métropolitain forecast that industrial gas demand

in the extension market would be 51.89 PJ in 1985, falling to 48.14 PJ by 1990. In the Montreal area, industrial gas demand was projected by Gaz Métropolitain to increase above 1980 volumes of 67.93 PJ, by 28.46 PJ in 1985, and by 27.72 PJ in 1990. Industrial natural gas demand for Quebec, excluding Hull and Rouyn-Noranda, was forecast to grow from 79.03 PJ in 1981 to 148.3 PJ by 1985 and to 143.79 PJ by 1990. Gulf forecast the industrial demand for natural gas in Quebec to increase to 20.0 PJ in 1985, 68.1 PJ in 1990, and by 76.2 PJ by the year 2000 as a result of incentives and the extension of the market to regions outside the present franchise area.

These forecasts of industrial demand differed as a result of different assumptions and methodology. Gaz Inter-Cité assumed conversion would rise from 15 percent of small industrial customers in the initial year of gas service to 85 percent of such customers by the sixth year of service, remaining constant thereafter. Gas was assumed to capture 20 percent of new industrial establishments initially, increasing to 30 percent by the fourth year, and then remaining constant at that level. Large industrial and interruptible loads were considered on an individual basis depending on competing fuels. Gaz Métropolitain assumed that conversions would rise from 8 percent of the small industrial market in the initial year of service to 40 percent of this market within 5 years and remain constant thereafter. In the large industrial market, it was assumed that 24 percent of the existing stock of plants would convert in the first year of gas service, rising to a cumulative total of 80 percent by the fourth year and remaining constant thereafter. The capture rate of new plant construction was assumed to be 60 percent throughout the forecast period, for both the small and large industrials. The capture and conversion rates of the remaining categories of very large and interruptible industrial demand were determined as a result of individual evaluation and consultation with the industry concerned.

Gulf's forecast was determined on a total energy basis. It assumed that the pipeline extension would increase gas availability in Quebec to 75 percent of the total industrial demand. Gulf expected that this would lead to a greater share of gas in the industrial sector, to some 25 percent of industrial demand by the year 2000.



Gaz Inter-Cité indicated that a 10 percent price advantage for natural gas relative to alternative fuels would be necessary during the first ten years to encourage penetration of the industrial sector. It also indicated that payment of 75 percent of conversion costs would be sufficient to encourage switching to natural gas. It was further assumed that export markets would be found for any surplus heavy fuel oil.

Gaz Métropolitain assumed price parity for natural gas with alternative fuels in the industrial sector, on an energy equivalent basis. It was also assumed that 100 percent of conversion costs would be paid on behalf of the customer and that export markets would be found for surplus heavy fuel oil.

Gulf was of the opinion that price parity with competing fuels would be sufficient to encourage gas penetration in the industrial sector. With regard to conversion to gas, Gulf suggested that incentives should be large enough to remove concerns regarding conversion costs.

Gaz Inter-Cité assumed that increases in industrial consumption resulting from higher industrial output would be counter-balanced by decreases due to energy conservation.

#### 4.1.4.3 Views of the Board

The Board's forecast of total industrial sector natural gas demand in Quebec is as follows:

#### DEMAND FOR NATURAL GAS - INDUSTRIAL SECTOR

<u>Forecast of NEB</u>			
(PJ/Year)			
<u>Year</u>	<u>Montreal</u>	<u>Extension Market</u>	<u>Quebec</u>
1981	63.3	6.5	69.8
1985	67.8	46.2	114.0
1990	89.9	60.1	150.0
2000	129.5	85.3	214.8

The demand for natural gas in industrial markets in Montreal and the proposed extension areas in Quebec is detailed more fully in Tables 4-2 and 4-3.

The Board's forecast uses TransCanada's relative price assumptions; namely, that the price of natural gas would be at parity with alternative fuels. The Board also assumes, as did TransCanada and Gaz Métropolitain, that conversion costs would be paid for on behalf of the customer.

Total industrial energy demand is forecast the same as prepared by the Board for its November 1979 Report. The estimate of industrial energy demand is divided into substitutable and non-substitutable energy demand both for Montreal and for the extension market. The analysis of the potential market penetration by gas assumes that natural gas would serve markets that would otherwise be served by heavy fuel oil. TransCanada's capture and conversion rate assumptions for the small, medium and large industrial markets were reviewed and subsequently used on a weighted-average basis to develop the Board's current forecast of market expansion volumes.

The expected market shares of gas and heavy fuel oil for the years 1980, 1990, and 2000 in the Board's forecast are shown in the following table.

MARKET SHARES (PERCENT) IN THE INDUSTRIAL SECTOR

NEB Forecast in Quebec

<u>Year</u>	<u>Total Industrial Energy</u>		<u>Substitutable Energy</u> <sup>(1)</sup>	
	<u>HFO</u> <sup>(2)</sup>	<u>Gas</u>	<u>HFO</u> <sup>(2)</sup>	<u>Gas</u>
1980	32.7	13.6	52.7	21.9
1990	13.2	30.0	21.6	49.3
2000	5.4	36.0	8.9	60.0

(1) Excluding electricity.

(2) Heavy Fuel Oil.

In comparison with the Board's forecast, TransCanada's projection of demand for natural gas in the extension area is about 30 PJ higher in the year 1990 and 39 PJ higher in the year 2000. Several factors are responsible for the difference between the two forecasts. First, the Board forecasts total industrial energy demand to grow at some 1.3 percent per year as compared with TransCanada's forecast of about

2.7 percent per year. Secondly, forecast market shares are different. In 1990, the Board forecasts an industrial sector market share for gas of 30.0 percent as compared with 34.4 percent projected by TransCanada. Also, unlike TransCanada, the Board has not included large commercial customers in the industrial sector.

Gaz Métropolitain provided a detailed forecast of industrial demand for gas and, for the year 1990, it projected Quebec industrial gas demand of 144 PJ. For the same year, the Board's forecast is 150 PJ. Gaz Métropolitain's forecast of industrial gas demand for the Montreal area was 96 PJ in 1990 compared with the Board's forecast of 90 PJ. In the extension market, Gaz Métropolitain projected the sale of gas to be 48 PJ in 1990 compared with the Board's forecast of 60 PJ.

## 4.2 Q & M

### 4.2.1 Overview

#### 4.2.1.1 Evidence of the Applicant

Natural gas sales volumes in New Brunswick and Nova Scotia, combined, were forecast by Q & M to reach approximately 32 PJ in 1985, and to increase to 45 PJ in 1990 and to 86 PJ in the year 2000. Details of this forecast, by market sector, are provided in Table 4-7 for New Brunswick and in Table 4-8 for Nova Scotia. Table 4-10 summarizes the combined volumes projected for the two provinces, while Figure 4-4 illustrates the combined total. The forecasts of the intervenors and the Board are also presented in these tables.

Q & M's forecast of natural gas demand assumed that 18 specific communities in New Brunswick and 12 communities in Nova Scotia would be served by natural gas. These service areas represented roughly one-half of all households in the two provinces. According to Q & M's schedule, natural gas service would commence by 1982.

The assumptions, methodology and the resulting forecast of gas demand are discussed in the following sections of this chapter for each of the residential, commercial and industrial market sectors. Tables and graphs are also presented to show Q & M's forecast along with those forecasts submitted by intervenors (Province of Nova Scotia and ICG Scotia Gas Ltd.) as well as that of the Board.

Q & M's estimates of gas demand in New Brunswick and Nova Scotia took into account the same market determinants as did TransCanada's Quebec demand forecast; i.e., relative prices of competing fuels, capture rates of new dwellings, conversions from other fuels, etc. However, Q & M did not necessarily adopt the same specific assumptions about these factors as TransCanada.

For New Brunswick and Nova Scotia, Q & M's price assumptions can be summarized as follows:

- (i) In the residential market, gas prices would be discounted by 20 percent against competing oil products for the first 10 years of operation, and by 10 percent for the following 10 years.



- (ii) In the commercial sector, gas prices would be discounted by 20 percent against competing oil products in the first six years of operation. Subsequently, the discount would be reduced linearly so as to eliminate the discount completely by the tenth year of operation.
- (iii) In the industrial sector, gas prices would be discounted by 15 percent against competing fuels, generally heavy fuel oil, for the first six years, with a linear reduction of the discount to zero by the tenth year.
- (iv) Domestic and world crude oil price assumptions were the same as those used by TransCanada.

The price assumptions listed above did not necessarily imply that the incentive discounts would be available at the burner tip, but rather that funds equal to these amounts would be available to distributors to be used at their discretion to promote rapid market penetration by natural gas. This could involve the payment of conversion costs, in part or in full, on behalf of the consumer.

On a market sector basis, Q & M's projections indicated for 1990 that approximately 18 percent of total natural gas sales were expected to be in the residential sector, 13 percent in the commercial sector and 42 percent in the industrial sector. The remaining 27 percent was accounted for by the thermal electric generation requirements projected by Q & M for Nova Scotia. Q & M did not forecast any thermal generation requirements for natural gas in New Brunswick. For the year 2000, 21 percent of total sales were projected for residential markets, 14 percent for commercial, 46 percent for industrial, and 19 percent for thermal electric generation.

#### 4.2.1.2 Evidence of Intervenors

Nova Scotia presented three forecasts of the demand for natural gas in Nova Scotia classified by residential, commercial and industrial sectors. These forecasts are summarized in the following table:

DEMAND FOR NATURAL GAS  
Comparison of Forecasts  
(PJ/Year)

<u>Year</u>	<u>Nova Scotia</u>			<u>New Brunswick</u>		<u>N.B. &amp; N.S.</u>
	<u>Symborski</u>	<u>Inter-City</u>		<u>Inter-City</u>	<u>Inter-City</u>	
	<u>N.S.</u>	<u>Base</u>	<u>Alternative</u>	<u>Gas</u>	<u>Gas</u>	<u>Gas</u>
1982	28.0	--	--	36.1 <sup>(a)</sup>	47.8 <sup>(a)</sup>	83.8 <sup>(a)</sup>
1985	43.3	38.5	46.3	46.2 <sup>(b)</sup>	59.3 <sup>(b)</sup>	105.6 <sup>(b)</sup>
1990	24.7	37.3	47.7	48.1 <sup>(c)</sup>	61.7 <sup>(c)</sup>	109.8 <sup>(c)</sup>
2000	37.4	56.5	63.8	-	-	-

(a) Second year of service

(b) Sixth year of service

(c) Tenth year of service

All three of the above projections had been developed by the Nova Scotia Energy Council. The most recent of these was contained in Nova Scotia's intervention. The other two forecasts were part of a study of capital and distribution costs filed by Nova Scotia which had been conducted by Symborski and Associates, concerning the design of the natural gas distribution system. These two projections were earlier forecasts by Nova Scotia Energy Council, using the same methodology as the most recent forecast, but developed under different assumptions.

ICG Scotia Gas Ltd. indicated that it had conducted an extensive market survey of both Nova Scotia and New Brunswick. Estimates of total energy demand based on this survey were provided, but these were classified only into thermal and general demand.

The demand forecasts of Nova Scotia and ICG Scotia Gas all employed essentially the same methodology which consisted, in the residential and commercial sectors, of multiplying the estimates of the number of customers by the corresponding average annual rate of energy consumption.

Industrial demand was determined to a large extent through discussions with the industries concerned.

#### 4.2.1.3. Views of the Board

The Board forecasts the following growth in natural gas demand in New Brunswick and Nova Scotia:

##### DEMAND FOR NATURAL GAS

##### Forecast of NEB

(PJ/Year)

<u>Year</u>	<u>Nova Scotia</u>	<u>New Brunswick</u>	<u>Nova Scotia and New Brunswick</u>
1982	5.6	0.5	6.1
1985	37.0	12.3	49.3
1990	21.6	21.0	42.7
2000	30.2	32.6	62.9

In developing its forecast of natural gas demand in the proposed market areas of New Brunswick and Nova Scotia, the Board was guided principally by the detailed information provided by Q & M. It also drew upon the evidence of the intervenors, some of whom gave additional guidance by submitting their own forecasts of natural gas demand.

The Board is of the opinion that Q & M's relative price assumptions would be reasonable under conditions of incentive pricing to promote penetration of markets by natural gas. The Board has, therefore, adopted Q & M's relative price assumptions for the purpose of developing its own forecast of gas demand. Specific details regarding the various assumptions, forecasting methodologies, and the forecast results are provided in the sections of this chapter dealing with residential, commercial and industrial markets.

Net sales of natural gas in New Brunswick are forecast by the Board to be approximately 12 PJ in 1985, 21 PJ in 1990 and 33 PJ in the year 2000. By the end of the forecast period, the residential sector is forecast to account for about 21 per cent of total net sales, with 17 per cent for commercial markets and 62 per cent for industrial markets. Table 4-7 presents the details of this forecast by market sector.

Net sales of natural gas in Nova Scotia are forecast to be approximately 37 PJ in 1985. This includes 25 PJ for thermal generation and steam production, but these requirements are almost completely phased out by 1988. Consequently, with significantly reduced thermal requirements for natural gas, total net sales are forecast to be about 22 PJ in 1990 and 30 PJ in the year 2000. By the end of the forecast period, 24 percent of total sales are expected to be in the residential market, with 25 percent commercial and 49 percent industrial. At that time, thermal generation requirements represent only two percent of the total. Table 4-8 presents the details of this forecast by market sector.

For the combined forecast for New Brunswick and Nova Scotia, total sales are projected to be 43 PJ in 1990 and 63 PJ in the year 2000. The combined forecast for the two provinces is presented in Table 4-10. (See also Figure 4-4). For the year 1990, the Board's forecast is approximately five percent lower than that of Q & M. For the year 2000, the forecast is about 27 percent lower, but a large part of this difference is the result of Q & M's projection that large amounts of natural gas will continue to be used for thermal generation.

With regard to total energy demand in New Brunswick and Nova Scotia, excluding the transportation sector, the Board estimates that natural gas will have a market share of approximately 17 percent in 1990 and 21 percent in the year 2000. The demand for both electricity and fuel oil is expected to be affected by natural gas penetration. For the year 2000, it is estimated that about 3.5 PJ of electricity, 17 PJ of light fuel oil and 41 PJ of heavy fuel oil will be displaced. Table 4-11 provides a summary of these estimates of the displacement of other forms of energy.

#### 4.2.2 Residential Sector

##### 4.2.2.1 Evidence of Q & M

With regard to residential demand in New Brunswick and Nova Scotia combined, Q & M projected that total sales of natural gas would be approximately 3.3 PJ in 1985, rising to about 8.2 PJ in 1990.



In developing its forecast demand for natural gas in the residential sector of proposed new markets in New Brunswick and Nova Scotia, Q & M followed a methodology similar to that used by TransCanada to prepare its Quebec forecast of residential demand.

Q & M utilized the provincial growth rates underlying household "Projection 4" of the 1975 Statistics Canada household projections, to forecast the number of households in the proposed natural gas service areas. In New Brunswick, this implied household growth of 1.8 percent per annum from 1976 to 1990, and 0.8 percent thereafter. The corresponding household growth in the proposed gas service area in Nova Scotia was projected at 1.6 and 0.6 percent per annum over the same two periods respectively.

The price discount for natural gas against competing oil products in residential markets in New Brunswick and Nova Scotia was assumed to be 20 percent for the first ten years of operation, ten percent for the second ten years, and zero thereafter. The funds materializing from the discount were assumed to be available to the distributor to be used as it saw fit. This could include a contribution to conversion costs to bring about conversions sooner than they would normally occur, the promotion of natural gas, and underwriting burner tip prices to be at an advantage relative to oil. Q & M assumed that the discounts would be reduced over time as the advantages of natural gas became better known. With regard to possible competition from electricity, Q & M indicated that it assumed that electricity would always be priced higher than oil. Since electricity also represented a less secure energy source in the Maritimes, being largely derived from imported crude oil, the primary competitor to natural gas was assumed to be light fuel oil in residential markets in both New Brunswick and Nova Scotia.

Given these assumptions with regard to interfuel competition, Q & M estimated that natural gas would capture 50 percent of new dwellings which would be constructed in the proposed natural gas service areas in New Brunswick and Nova Scotia.

Q & M further assumed that natural gas would penetrate in existing dwellings at the following rate:

GAS PENETRATION OF RESIDENTIAL CONVERSION MARKETS

Q & M Forecast  
(as percent of total conversion market)

1980	3%
1985	12%
1990	24%
1995	36%
2000	48%

Q & M derived the above rates taking into consideration both the high rates of market penetration achieved by gas in other regions of Canada, and competition in local markets from an entrenched oil establishment. In addition, funds sufficient to cover associated conversion costs were said to have been allowed for in the assumed price discounts.

Forecast average use of natural gas per dwelling was estimated to be .015 GJ per degree day for heating loads, and 26 GJ per year for base loads, in each community throughout the forecast period. This implied, for example, total average use per dwelling of 153 GJ per year in Fredericton, and 143 GJ per year in Halifax, taking into account the respective number of degree days.

The current average use per dwelling was estimated from data of distribution companies elsewhere in Canada, and was adjusted downwards to reflect conservation. A ten percent reduction held constant over time was included in the heating load factor. This was interpreted by Q & M as giving the same accumulated ten-year consumption as would result from a two percent per annum decline from current levels of average use. No allowance was made for changes in the mix of dwellings over the forecast period, nor for differences in consumption patterns of new versus existing dwellings.

#### 4.2.2.2 Evidence of Intervenors

Three forecasts of the residential demand for natural gas in Nova Scotia were provided in the intervention and supporting studies presented by the Government of Nova Scotia as follows:

DEMAND FOR NATURAL GAS - RESIDENTIAL SECTORForecasts of Nova Scotia

(PJ/Year)

<u>Year</u>	<u>Nova Scotia</u>	<u>Symborski and Associates</u>	
		<u>Base Case</u>	<u>Alternative Case</u>
1985	2.0	2.0	6.7
1990	3.9	4.0	10.9
2000	7.5	8.5	15.8

The forecast presented in the intervention of Nova Scotia was the most recent forecast of the Nova Scotia Energy Council and is summarized above. Two earlier forecasts of the Nova Scotia Energy Council, a base and an alternative case, were presented in the study of capital and distribution costs by Symborski and Associates, accompanying the intervention of Nova Scotia and are also summarized above.

The Province indicated that consumers in Nova Scotia could not accept prices greater than the burner tip price prevailing in Ontario and Quebec. It was indicated that prices should be slightly less, on a thermal equivalent basis, than traditional energy sources, usually oil. Nova Scotia also assumed that the distributor would adopt an aggressive marketing strategy which would include the payment of conversion costs.

Under this set of assumptions, Nova Scotia estimated, as did Q & M, that 50 percent of new residential units would install natural gas. In residential conversion markets it was assumed that in 1982 a concerted marketing campaign would result in 60 percent of that year's expected oil furnace replacement market converting to natural gas. Some portion of these conversions, however, was attributed to early retirement of existing furnaces. After 1982, Nova Scotia assumed that 20 percent of expected replacements would be gas, i.e. one percent per annum of the dwellings existing in 1982. Average annual consumption per residential customer was assumed to include uses for space-heating, cooking and clothes-drying. New single-detached, semi-detached, apartments and mobile homes were assumed to have average annual space heating requirements of 51.1 GJ, 30.7 GJ, 26.4 GJ and 36.9 GJ respectively in terms of output energy. It was estimated that both new and existing

housing stock would require 14.3 GJ per unit for water-heating. Gas appliance requirements were forecast to decline 2 percent in 1979 from the present level of 15.5 GJ per household per year, and to remain constant thereafter.

The two forecasts in the Symborski and Associates study had used different assumptions and information about the market base, conversion rates, and average unit consumption than the more recent forecast described above. In these earlier forecasts, average unit consumption was calculated by converting average fuel oil consumption of 1200 gallons to the energy equivalent, and by adjusting for conservation to arrive at a requirement of 175 GJ annually for existing structures and 142 GJ annually for new structures. Three percent of existing structures were assumed to convert to gas in the initial year of service, and one percent in each year thereafter. Gas was assumed to capture 50 percent of new residential structures.

The alternative case was based on the premise that gas would be available at the burner tip at a significant price advantage over conventional fuels, that assistance would be made available for payment of conversion costs, and that there would be an incentive promotion and consumer education campaign. This was expected to increase the conversion rate of existing households in small centres to 25 percent in each of the first two years, so that a total of 50 percent would be converted to gas by the end of the second year. Larger load centres such as Sydney, Truro, and Glace Bay were assumed to convert at ten percent per year for five years. Dartmouth and Halifax were assumed to convert at three percent the first year, and two percent per year thereafter. These factors resulted in a correspondingly higher demand forecast.

ICG Scotia Gas, while not providing the results of its market survey, did indicate the specific assumptions underlying its forecast of the natural gas demand in the residential sector in the proposed service areas of Nova Scotia. The residential housing stock



inventory was multiplied by annual rates of growth varying from 0.0 to 1.816 percent (determined on a county basis by the Nova Scotia Department of Development), to arrive at estimates of the housing stock throughout the forecast period. ICG Scotia Gas indicated that gas should be priced ten percent below alternative fuels and that 75 percent of conversion costs should be paid on behalf of the customers. Under these assumptions, the capture rate of new structures increased from 50 percent in the first year of service to 75 percent the second year, remaining constant thereafter. The conversion rate of existing structures increased from 10 percent initially to 75 percent by the tenth year.

No intervenor provided a forecast of natural gas demand in the residential sector in New Brunswick.

#### 4.2.2.3 Views of the Board

The Board's forecast of the potential demand for natural gas in the residential sector in New Brunswick and Nova Scotia was developed using Q & M's price assumptions. The resulting forecast is as follows:

#### DEMAND FOR NATURAL GAS - RESIDENTIAL SECTOR

##### Forecast of NEB

(PJ/Year)

<u>Year</u>	<u>Nova Scotia</u>	<u>New Brunswick</u>	<u>Nova Scotia and New Brunswick</u>
1982	0.1	0.1	0.2
1985	3.8	3.2	7.0
1990	5.7	5.1	10.8
2000	7.3	6.7	14.0

This forecast is 2.6 PJ higher than that of Q & M in 1990, becoming roughly the same by 1995, and 3.7 PJ lower by 2000. The various assumptions utilized by the Board in developing its forecast of gas demand in residential markets are discussed below.

Taking into account the latest Statistics Canada population projections, the Board estimates household growth in New Brunswick and Nova Scotia and in the gas service area, as follows.

AVERAGE ANNUAL GROWTH IN NUMBER OF HOUSEHOLDSNEB Estimate

(percent/year)

<u>Period</u>	<u>Total Province</u>		<u>Proposed Gas Service Area</u>	
	<u>New Brunswick</u>	<u>Nova Scotia</u>	<u>New Brunswick</u>	<u>Nova Scotia</u>
1976-1990	2.3	1.8	3.1	2.3
1990-2000	0.9	0.7	1.6	1.1

For purposes of this forecast of growth in the number of households in the proposed service area, the Board estimates that in New Brunswick, approximately 45 percent of all households would have been in the service area in 1976, but that this would increase to 54 percent by 2000. Similarly in Nova Scotia, the proportion of households in the proposed service area is estimated to increase from 44 percent as in 1976, to 49 percent by the end of the forecast period. The Board's projected household growth is significantly faster than that of Q & M, which had utilized an earlier set of Statistics Canada population and household projections.

Q & M's assumption that natural gas would capture 50 percent of new dwellings has been adopted by the Board for both New Brunswick and Nova Scotia. Although Q & M indicated that its 20 percent price discount would mainly allow for the provision of funds for conversion costs and promotion of natural gas, the possibility of some remaining discount at the burner tip was not ruled out. Under this assumption, that natural gas would be priced equivalent to light fuel oil, or a little lower, the 50 percent gas capture seems reasonable. It is expected however, that this capture rate may be somewhat low for Nova Scotia, as a result of increasing concern regarding security of supply, and somewhat high for New Brunswick, where there are indications that electricity has been capturing a significant share of new residential markets. The acceptability of natural gas in unproven markets is also a factor of forecasting uncertainty, as this may limit the penetration of natural gas in new markets, to some extent. The assumed 50 percent

capture rate is consistent with that assumed by the Government of Nova Scotia, but is lower than the 75 percent capture rate assumed by ICG Scotia Gas for the second and subsequent years of service.

The conversion base available to natural gas in New Brunswick and Nova Scotia is assumed to consist of existing oil-heated dwellings only. Hence, no conversions are assumed to occur from homes heated by electricity or wood, or from other unconvertible dwellings such as mobile homes. The Board's projected conversion base is 30 percent lower in New Brunswick, and 17 percent lower in Nova Scotia than Q & M's.

With regard to penetration of the conversion base by natural gas, the Board assumes that if natural gas were priced competitively with light fuel oil, it will capture 50 percent of potential furnace replacements, estimated to be five percent of existing dwellings each year. In addition, since the Board assumes that conversion costs will be paid on behalf of consumers, the overall rate of penetration of the conversion base could occur at a significantly faster rate. This is allowed for in the Board's forecast by assuming that the overall rate of penetration of the conversion base will be roughly twice as fast in the first five years after the initiation of gas service in New Brunswick and Nova Scotia, than it would otherwise be. Hence, the overall rate of penetration of the conversion base is assumed to increase to 30 percent in 1987, reaching 50 percent by the year 2000. This rate of penetration by natural gas is faster than that implied by Q & M, although there is little difference over the long run. Q & M assumed a very slow rate of penetration of residential conversion markets, which seems unwarranted given that conversion costs would be paid by the distributor. The Board's estimated rate of penetration of the conversion base is also faster than that of the Government of Nova Scotia, which assumed a rate of 20 percent, although Nova Scotia stated that under a concerted marketing campaign in the first year of natural gas service, the rate of penetration of the conversion base could be tripled to 60 percent for that year's expected furnace replacement market. The Board's forecast gas penetration rate is considerably lower than that of ICG Scotia Gas,

which assumed that 67 percent of existing dwellings could be converted to natural gas by 1986.

Taking both the forecast number of dwellings in the conversion base, and the rate of penetration of that base into account, the Board's forecast number of conversion customers is three percent lower than that of Q & M for New Brunswick in 1990, and 16 percent higher for Nova Scotia. Of the total number of households in the gas service area in New Brunswick and Nova Scotia, 32 percent are forecast to use natural gas in 1990, and 43 percent in 2000, taking both new and conversion customers into account.

The Board has employed the same estimates for consumption of natural gas by type of dwelling for New Brunswick and Nova Scotia, as for Quebec, with the exception that degree day differences are taken into account. It is projected that the proportion of dwellings consisting of singles will remain relatively constant in the gas service area in New Brunswick, and will decline slightly in Nova Scotia. Hence average use per dwelling for all types of dwellings is forecast as indicated below.

AVERAGE USE PER DWELLING

NEB Estimate

(PJ/Year)

	<u>New Brunswick</u>	<u>Nova Scotia</u>
1982	156	141
1985	150	134
1990	138	124
1995	127	114
2000	117	104

This estimated average use per dwelling is comparable to that of Q & M in the initial part of the forecast period. However, Q & M's estimate is significantly higher by 2000, mainly as a result of differences in the allowance for additional conservation.



The Board's forecast of demand for natural gas in residential markets in New Brunswick and Nova Scotia is shown in comparison to that of Q & M in Table 4-10. The Board's forecast is higher than that of Q & M in the first part of the forecast period mainly as a result of the Board's estimate of a faster rate of penetration of the conversion base and a higher rate of household growth. However, the Board's forecast eventually drops below that of Q & M, as a result of the decline in the forecast average use per dwelling.

While the extension of natural gas markets to New Brunswick and Nova Scotia is expected by the Board to occur largely at the expense of light fuel oil, a small amount of electricity displacement could also occur. The Board estimates that 12 PJ of light fuel oil and 2 PJ of electricity would be displaced in the year 2000 in the combined market.

#### 4.2.3 Commercial Sector

##### 4.2.3.1 Evidence of Q & M

With regard to commercial demand in New Brunswick and Nova Scotia combined, Q & M projected that total sales of natural gas would be approximately 2.3 PJ in 1985, rising to about 5.8 PJ in 1990, and 12.4 PJ in 2000.

Q & M estimated commercial natural gas demand in New Brunswick and Nova Scotia on the basis of forecasts of the number of commercial customers in each community and average gas use per customer. The number of commercial gas customers in each community was assumed to be 10 percent of the number of residential gas customers. This figure closely corresponded to the current ratio between commercial and residential gas customers for Canada as a whole. As gas is presently not being used in Nova Scotia and New Brunswick, Q & M examined the ratio of commercial electricity customers to residential electricity customers in the Maritimes and found the ratio close to ratios for gas customers in other provinces.

Average use per customer in each community was estimated as the sum of base and heating loads. Based on an analysis of data on Canadian

utilities, base load was assumed at 212 GJ per customer and heating load at .099 GJ per degree day per customer. Conservation of 10 percent was applied to the heating load factor at the beginning of the forecast period. According to Q & M, if the heating load factor declined at 2 percent per annum, the resulting accumulated ten-year gas consumption would be identical to that which resulted from the 10 percent reduction used in the forecast. No conservation was assumed for the base load.

As a proxy for incentives needed to realize the forecast demand, Q & M assumed the burner tip price of gas in the commercial sector to be 20 percent below the burner tip prices of competing oil products for the first six years of operation. This discount was assumed to be linearly reduced to zero by the tenth year.

#### 4.2.3.2 Views of Intervenors

Demand for natural gas in the commercial sector was forecast by Nova Scotia as follows:

#### DEMAND FOR NATURAL GAS - COMMERCIAL SECTOR

##### Forecasts of Nova Scotia

(PJ/Year)

<u>Year</u>	<u>Nova Scotia</u>	<u>Symborski and Associates</u>	
		<u>Base Case</u>	<u>Alternative Case</u>
1985	3.9	1.1	4.2
1990	7.6	4.1	7.6
2000	15.3	13.3	13.3

The Province of Nova Scotia indicated that data from a census of commercial units revealed that 80 percent of total commercial establishments were located in the proposed service area. The number of establishments was assumed to increase at an annual rate of 3.5 percent, slightly less than the forecast rate of growth for Real Domestic Product. Thirty percent of existing commercial establishments were assumed to convert to gas by 1990, increasing to 40 percent by 2000. Fifteen percent of new establishments were assumed to be captured in the initial year, increasing to 85 percent by 1990, and remaining constant thereafter.

Commercial average energy requirements per establishment were assumed to be 529 GJ for space and water heating, and 205 GJ for lighting and equipment. These average use figures were then adjusted upwards by 14 percent to reflect the fact that commercial establishments in the service area were larger than the provincial average.

The base case forecast provided by Nova Scotia contained in the Symborski and Associates study assumed that ten percent of new commercial structures would be captured in the initial year of service, increasing to 70 percent by 1992, and remaining constant thereafter. Conversions of existing commercial establishments were assumed to reach 30 percent in the initial year and to reach 40 percent by 1995. Average annual commercial consumption for both old and new structures was assumed to be 791 GJ, of which 63.3 GJ was base load. This forecast did not include any revisions to the market base resulting from the survey of establishments carried out by the Nova Scotia Department of Development.

The alternative forecast in the Symborski and Associates study assumed a 70 percent capture rate of new commercial structures. Conversion of existing structures was assumed to reach a maximum of 70 percent in each municipality - within two years in small centres, and within seven years in Halifax and Dartmouth. These increases in capture and conversion rates were predicated upon the assumption that gas would be available at a significant price advantage over conventional fuels, that conversion assistance would be available, and that an extensive educational and marketing campaign would be pursued.

Nova Scotia did not indicate the specific price of gas assumed for the commercial sector, other than to state that it should either be less than that of alternative fuels, on a thermal equivalent basis, or have a discount relative to other fuels similar to that offered in Ontario. The magnitude of conversion cost assistance would depend upon how competitively gas was priced.

Although it did not present its commercial sector forecast during the hearing, ICG Scotia applied the same county growth rates to the existing stock of commercial structures as it had applied to

the residential sector. These county growth rates varied from 0.0 to 1.816 percent per year, considerably lower than the 3.5 percent assumed in Nova Scotia's forecast. Fifty percent of new structures were assumed to be captured in the initial year of service, increasing to 75 percent the second year and remaining constant thereafter. Conversion of existing structures was assumed to increase from 15 percent in the first year and to reach 85 percent by the tenth year.

ICG Scotia indicated that natural gas should be priced 10 percent below alternative fuels and that 75 percent of conversion costs should be paid on behalf of the customer.

None of the interventions provided a forecast of natural gas demand in the commercial sector in New Brunswick.

#### 4.2.3.3 Views of the Board

The Board forecasts the demand for natural gas in the commercial sector in New Brunswick and Nova Scotia to increase from about 6 PJ in 1985 to about 9 PJ in 1990 and 13 PJ in 2000. This forecast is higher than Q & M's for the period until 1990, after which the difference between the two becomes smaller. By 2000, there is little difference between the forecasts, with the Board's estimate being less than 1 PJ higher.

The Board's forecast of natural gas demand in the commercial sector in New Brunswick and Nova Scotia is based on the methodology and relative price assumptions used by Q & M. The Board's estimates, however, of the number of commercial gas customers and average use per customer are different from those of Q & M.

The methodology and assumptions underlying the Board's forecast of residential gas customers are described in detail in the section on residential demand. Like Q & M, the Board assumes one commercial gas customer for every ten residential customers starting in the early part of the forecast period. A survey of historical data on gas customers by sector showed that in some provinces, namely, Ontario and Manitoba, a ratio of 10:1 between residential and commercial gas customers was attained after about ten years of gas service. In Quebec, the latest



available statistics show 14 residential gas customers for every commercial gas customer, although the ratio is reduced to 10:1 if only heating residential customers are compared with commercial customers. As the Board accepts Q & M's assumption that conversion costs will be paid through price discounts and also because about 70 per cent of the commercial establishments in New Brunswick and Nova Scotia are likely to be included in the proposed service area, the Board believes it is reasonable to assume one commercial customer for every ten residential customers.

The average use of gas per commercial customer is determined by adding estimates of base and heating loads per customer. Based on an analysis of historical data for Quebec and Ontario relating to average annual use per commercial customer, use during the non-heating season, and the number of degree days, the base load per customer was estimated to be 316 GJ. This estimate is higher than Q & M's estimate of 212 GJ per customer. Based on the same analysis of Quebec and Ontario data, the Board estimates heating load at 0.095 GJ per degree day, which is slightly lower than Q & M's estimate of 0.099 GJ per degree day.

The Board estimates that the weighted average degree days in the proposed service areas of New Brunswick and Nova Scotia are 8931 and 7965, respectively. Combining these degree days with assumptions regarding base and heating loads, average use per commercial customer is estimated to be 1164 GJ in New Brunswick and 1073 GJ in Nova Scotia.

The Board assumes that expansion of gas sales into New Brunswick and Nova Scotia would mainly displace demand for petroleum products. However, as petroleum product demand is reduced, the amount of electricity displaced (expressed as a percentage of fuels displaced by natural gas) is expected to increase gradually from some 4 per cent in 1985 to 5 per cent in 1990 and 12 per cent in 2000.

#### 4.2.4 Industrial Sector

##### 4.2.4.1 Evidence of Q & M

Q & M projected total industrial sales of natural gas in New Brunswick and Nova Scotia as follows:

#### DEMAND FOR NATURAL GAS - INDUSTRIAL SECTOR

##### Forecast of Q & M

(PJ/Year)

<u>Year</u>	<u>Nova Scotia</u>	<u>New Brunswick</u>	<u>Nova Scotia and New Brunswick</u>
1982	0.1	0.4	0.4
1985	2.8	5.5	8.3
1990	6.6	12.2	18.9
2000	13.9	25.5	39.4

Q & M's gas demand projections for the industrial sector were based on the assumption that price discounts for natural gas would be available to distributors in the early years of the project. Effective burner tip prices of natural gas would be sufficiently below prices of competing oil products to ensure a reasonable rate of conversion of existing energy customers and to attract a high proportion of new customers. It was expected that the gas price discount would generally be in relation to heavy fuel oil prices, but that it could be relative to some other fuel, if the latter happened to be the least cost alternative fuel in a particular area. The discount was assumed to be 15 percent for the first six years of service, linearly reduced to zero by the tenth year.

Q & M's price assumption did not necessarily imply that discounts would actually show up as lower burner tip prices. Funds calculated on the discount price basis could be used by distributors to pay conversion costs, in part or in full, or used in some other fashion to promote sales of natural gas.

To develop its industrial gas demand forecast for New Brunswick and Nova Scotia, Q & M first estimated the potential industrial load in 1980. This was done by using Statistics Canada sales data for 1976,

and escalating it at a rate of two percent per annum to the year 1980. The resulting data base was modified on the basis of a market survey of industrial firms in the proposed market area.

An initial estimate of total industrial energy demand was adjusted downwards by removing industrial usage that was considered inappropriate for conversion to natural gas. The net industrial energy requirement (net of electricity) was then increased over the forecast period at an average annual growth rate of 2.0 percent, after taking account of energy conservation. Initially the average annual growth rate of total industrial energy was estimated to be 3.5 percent. Conservation was estimated to be 1.5 percent per year, leaving the growth rate, net of conservation, to be 2.0 percent per year.

Natural gas demand was derived by applying gas penetration rates to the substitutable industrial energy demand forecast. Q & M assumed penetration rates of 16 percent in 1985, rising to 29 percent in 1990, and to 42 percent in 1995, and remaining constant thereafter.

#### 4.2.4.2 Views of Intervenors

Industrial demand for natural gas was forecast by Nova Scotia as follows:

#### DEMAND FOR NATURAL GAS - NOVA SCOTIA INDUSTRIAL SECTOR

(PJ/Year)

<u>Year</u>	<u>Nova Scotia</u>	<u>Symborski and Associates</u>
1985	10.2	13.7
1990	11.3	15.9
2000	13.9	21.4

Nova Scotia developed its forecast by identifying those industries with a high probability of conversion. The number of conversions was then determined based upon the location of these industries with regard to the pipeline and distribution system. The forecast assumed that two of the Province's pulp and paper mills, as well as the Sydney steel mill, would convert from heavy fuel oil to gas. In addition, conversions were assumed for the carpet mill in Truro, and for a metal fabrication plant and the food and beverage plants

located near the Halifax metro area. It was found that 75 to 80 percent of existing industrial demand was located in the proposed service area in Nova Scotia and 53 percent would likely convert to gas. This percentage was then assumed applicable to industrial expansion. Future industrial energy demand was forecast by applying specific industry growth rates to the present energy requirements of each type of industry. These growth rates were based on the Department of Development's projections of economic growth in each industry classification, and they assumed a slightly less than one to one correspondence between increases in energy demand and increases in Gross Domestic Product.

The Symborski and Associates study was based on direct contact with potential gas customers to determine estimated fuel consumption during the study period. No allowance was made for additional new industries, or for industrial loads not specifically designated. However, loads that were connected were assumed to increase at 3 percent per year after attachment.

Nova Scotia did not indicate the specific price of gas assumed for the industrial sector, but stated that gas should be priced at less than the thermal equivalent price of traditional energy sources. It was suggested that conversion cost assistance could be as high as 100 percent of the total cost, depending on how natural gas was priced.

ICG Scotia indicated that it had conducted an extensive survey of industrial customers. In each service area, surveys of large loads were conducted to determine the type of fuel presently being used, annual fuel consumption, peak day and peak hour requirements, unit cost, and potential future expansion. Examples of these surveys were provided for Truro and Edmundston, showing a greater number of industries than had been indicated by Nova Scotia or in the Symborski and Associates study.

ICG Scotia was of the opinion that gas should be priced at a 10 percent discount relative to competing fuels and that 75 percent of



conversion costs should be paid on behalf of the customer to ensure rapid market penetration. In addition, it pointed out the necessity of finding a market for surplus bunker "C" fuel oil outside the proposed service area.

No intervenor provided a forecast of natural gas demand in the industrial sector in New Brunswick.

#### 4.2.4.3 Views of the Board

The Board forecasts the following growth in the demand for natural gas by the industrial sector in New Brunswick and Nova Scotia:

##### DEMAND FOR NATURAL GAS - INDUSTRIAL SECTOR

##### Forecast of NEB

(PJ/Year)

<u>Year</u>	<u>Nova Scotia</u>	<u>New Brunswick</u>	<u>Nova Scotia and New Brunswick</u>
1982	0.2	0.3	0.5
1985	4.9	6.7	11.6
1990	8.9	12.2	21.2
2000	14.7	20.2	35.0

The Board's forecast of natural gas demand in the industrial sector for New Brunswick and Nova Scotia is based on assumptions and methodology similar in effect to those of Q & M. In particular, this similarity relates to Q & M's assumptions regarding conversion costs and the burner tip price of natural gas relative to fuel oil. In addition, the forecast is developed within the framework of the Board's base case forecast of total industrial demand for energy for the Atlantic region.

The Board's forecast of total industrial gas demand in New Brunswick and Nova Scotia is 21 PJ in 1990 and 35 PJ in the year 2000. This implies a market share for gas of 25 percent in 1990 and 35 percent by the year 2000. In this forecast, natural gas, for the most part, displaces heavy fuel oil.

The Board's forecast of demand for natural gas in the Maritimes in 1990 is about 2 PJ higher than that of Q & M, and about 5 PJ lower in

the year 2000. These differences are not large and result mainly from the differences in forecasts regarding the growth rate of substitutable industrial energy demand and gas penetration rates.

The Board's forecast for Nova Scotia for 1990 lies between that of Q & M and that of Nova Scotia. By the year 2000, all three forecasts are more or less the same.

In the study done for Nova Scotia, Symborski and Associates presented a higher gas demand forecast which resulted from estimates of higher rates of growth and very rapid conversion. Symborski and Associates' forecast of about 14 PJ for 1985 is approximately the same as the estimates of natural gas demand for the year 2000 made by Nova Scotia, the Board, and Q & M. It had estimated that after 1985, gas demand would increase at the rate of 3.0 percent per year, a higher growth rate than is forecast by the others.

The Board's forecast of demand for natural gas in the industrial sector in New Brunswick is 12.2 PJ in 1990, the same as that of Q & M, but, for the year 2000, the Board's forecast is 5.3 PJ lower than Q & M's.

#### 4.2.5 Thermal Electric Sector

##### 4.2.5.1 Evidence of Q & M

In developing its estimate of the demand for natural gas in the thermal electric sector, Q & M assumed that no existing oil-fired plants in New Brunswick would be converted to burn natural gas while two oil-fired plants in Nova Scotia, Tuff's Cove and Point Tupper No. 1, would be converted. Q & M also assumed that the conversion in Nova Scotia would take place as soon as gas became available in the area.

Q & M's estimated gas demand for thermal generation of electricity was 18.7 PJ in 1983, reducing to 10.3 PJ in 1991, and increasing thereafter to 16.6 PJ by the year 2000. For the period to 1992, these estimates were based on data supplied to Q & M in late 1978 by Nova Scotia Power in the light of that utility's earlier concepts of operating expectations. Beyond 1992, however, the forecast was based on Q & M's expectations of a continued and slightly increasing demand for natural gas for thermal generation of electricity.

#### 4.2.5.2 Views of Intervenors

Inter-City estimated a constant annual gas demand of 17.2 PJ for New Brunswick and 18.9 PJ for Nova Scotia from the second to the tenth year of service of the proposed gas pipeline. If the pipeline were in place by 1982, this forecast would apply for the period 1983 to 1993. No estimates were provided for the period beyond 1993. Inter-City's estimates for New Brunswick were based on information received from New Brunswick Power and were indicative of the thermal loads in the period. This information assumed conversion of the oil-fired Coleson Cove plant to gas, was based on domestic thermal loads and did not include generation of power for exports. Inter-City's estimates for Nova Scotia, on the other hand, were based on Nova Scotia Power's total electricity load in 1978. The 1978 gas demand was obtained by subtracting from the electricity load, energy generated by hydro and coal-fired thermal plants. This constant value was then applied throughout the review period.

New Brunswick indicated that conversion of the Colesons's Cove plant to gas and its operation at 50 per cent capacity factor would result in an annual demand of 31.6 PJ. It was acknowledged however, that when the Lepreau No. 1 nuclear unit comes into service the amount of oil or gas required for thermal generation would be reduced, although this could increase in subsequent years as the system loads grow. Evidence also showed that as the prospects for continuing and increasing hydro energy purchases from Quebec were good, the demand for heavy fuel oil or gas for thermal plants could diminish.

Nova Scotia estimated that demand for natural gas for thermal generation, as well as for steam production from Point Tupper No. 1 for the Port Hawkesbury heavy water plant, would remain relatively constant at 26.4 PJ, plus or minus 1 PJ per year, for the period 1982 to 1986, would drop to 16.9 PJ in 1987 and would decrease dramatically thereafter to about 1 PJ annually. The fuel estimates were obtained from Nova Scotia Power and were based on their "Balanced Option" expansion plan.

These estimates assumed a 3.4 percent annual load growth with 10.5 PJ used for steam production, while import purchases in the years 1981 to 1990 were restricted to 7.9 PJ annually.

The electricity demand forecast as provided to the Province of Nova Scotia by Nova Scotia Power, however, did not take into account the effect of introduction of gas into the market, although the Province did estimate that electricity displaced by gas penetration could range from 48 GW.h in 1982 to 885 GW.h by the year 2000. The program also provided the option to convert all or most of the oil-fired plants initially from oil to gas, if this were economically viable, and then to coal when coal becomes available in 1987 after a proposed new mine is opened. Gas for thermal generation would thus be phased out at that time. This was in accordance with the Nova Scotia Government's policy to reduce its dependence on imported oil as expeditiously as possible.

Nova Scotia Power acknowledged that its fuel estimates reflected the maximum amount of oil which it expected to use or the maximum amount which could be substituted for gas. Gas purchases would be structured in such a way as to minimize costs. This could include both firm and interruptible volumes in some as yet undefined blend. Nova Scotia Power indicated a willingness to enter into contracts for gas provided the economics were favourable and for a period to 1987 when coal is predicted to become available from a new mine.

#### 4.2.5.3 Views of the Board

The Board notes the possibility of substituting gas for heavy fuel oil for thermal generation in New Brunswick through conversion of the 1000 MW oil-fired Coleson Cove plant. It is the Board's view that the generation supply alternatives available to New Brunswick, namely, the coming into service of the 630 MW Lepreau No. 1 nuclear power plant in 1981 and the opportunities for continuing and increasing purchases of hydro energy from Quebec coupled with the termination of the 400 MW export from Coleson Cove in 1987, could considerably reduce the demand for heavy fuel oil for thermal plants. Consequently, the volumes of gas that might be used to displace heavy fuel oil could be quite limited.



The Board, therefore, considers the conversion of the Coleson Cove plant to gas as unlikely and concurs with Q & M that no gas for thermal generation purposes should be allocated for New Brunswick.

The Board has reviewed the estimates of demand for natural gas for thermal generation and steam production for the Port Hawkesbury heavy water plant in Nova Scotia. It generally concurs with the estimates provided by Nova Scotia Power to the Province of Nova Scotia, as these were based on that utility's latest operating expectations. For the purpose of its own forecast, the Board has reduced these estimates somewhat to reflect the quantity of electricity displaced by natural gas penetration into the market, as this factor would principally affect the marginal source of generation which, in this instance, could be fuelled either by heavy fuel oil or by natural gas. The Board's estimates are displayed in Table 4-9.

The Board recognizes that in order to reduce Nova Scotia's dependence on imported oil the Province's planned generation program provides for continued expansion of coal-fired plants as well as the conversion of most of the existing oil-fired plants to coal by 1987 when coal is expected to become available from a new mine. Natural gas therefore is the only viable fuel available to displace heavy fuel oil in the period preceeding conversion to coal. In addition, the continued use of natural gas in lieu of coal appears unlikely, even taking into account the significant costs of conversion to coal, because coal prices, although uncertain, are expected to be considerably below those of gas. The Board therefore concurs that the natural gas volumes for thermal generation purposes beyond 1988 could be small and consequently disagrees with the estimates provided by Q & M, especially in the period after 1988.

The Board cautions that its gas forecast volumes are the maximum foreseeable based on the expected load and generation patterns supplied by Nova Scotia Power and that these could be affected by many factors. Because oil is the marginal source of generation, the demand for natural gas could vary due to changes in the electric load forecast and changes in the levels of imports, as well as due to delays in the

generation program. These estimates could be particularly affected by a shutdown of the Port Hawkesbury heavy water plant because of either heavy water surpluses, which could arise from any slowing down of Canada's nuclear power program, or from any prolonged breakdown of the heavy water plant.

The Board also notes that gas used for thermal generation in the period 1982 to 1987 accounts for the bulk of the total projected gas demand for Nova Scotia and this hinges on one customer, namely Nova Scotia Power. The Board's forecast therefore presupposes that appropriate gas pricing arrangements would be developed to ensure an adequate gas price discount in relation to heavy fuel oil. It recognizes Nova Scotia Power's intention to minimize its costs by structuring its purchases to include both firm and interruptible volumes in some as yet unspecified blend; however, the Board assumes that the utility will enter into gas contracts for the total annual volumes indicated, especially for the period preceeding the expected conversion of some of its thermal plants to coal.

#### 4.2.6 Export Market

##### 4.2.6.1 Evidence of the Applicant

Q & M included as part of its application a proposal to export  $2.57 \times 10^9 \text{ m}^3$  of natural gas annually to the Northeastern United States through a lateral to St. Stephen, New Brunswick. At this point, the natural gas would be exported to a proposed new United States pipeline system for delivery to market.

The potential United States customers for the proposed export volumes would be TransCo and Algonquin. There were no firm contracts with the United States companies for the proposed export volumes at the time of the hearing.

##### 4.2.6.2 Views of Intervenors

Consolidated, Consumers', IPAC and Ontario all submitted that the Board should not include export volumes in its consideration of the Q & M application for a pipeline certificate because there was no

application before the Board for an export licence under Part VI of the Act. It was held that an application for an export licence should have been filed by Q & M in the Licence Phase of the hearing.

CPA stated it made no economic sense to transmit Western Canadian gas to New Brunswick for export when it could be exported at border points in Western Canada. The revenue flowback to producers from the export would be reduced by exporting via New Brunswick.

IPAC submitted that the Board should ignore the export case since there were no contracts in place for export sales. IPAC adopted CPA's view on exports at border points other than St. Stephen.

Norcen held the same view as CPA and added that the fuel and losses associated with transmitting the gas to New Brunswick for export represented an enormous waste of energy.

In Consumers' opinion, Q & M had not made its case for export. It noted the lack of a firm sales contract with United States customers, and the lack of a removal permit from Alberta. In addition, it considered that the firm contract term of twelve to fifteen years required by the United States buyers was unrealistic in light of the duration of new export licences granted by the Board in its Licence Phase Decision.

Ontario submitted that there appeared to be more efficient ways of moving gas to export market through existing facilities.

Quebec held that it would be more economic to export from Quebec than from New Brunswick.

#### 4.2.6.3 Views of the Board

The Board's decision with respect to the export component of Q & M's application is contained in Chapter 11 of the report.





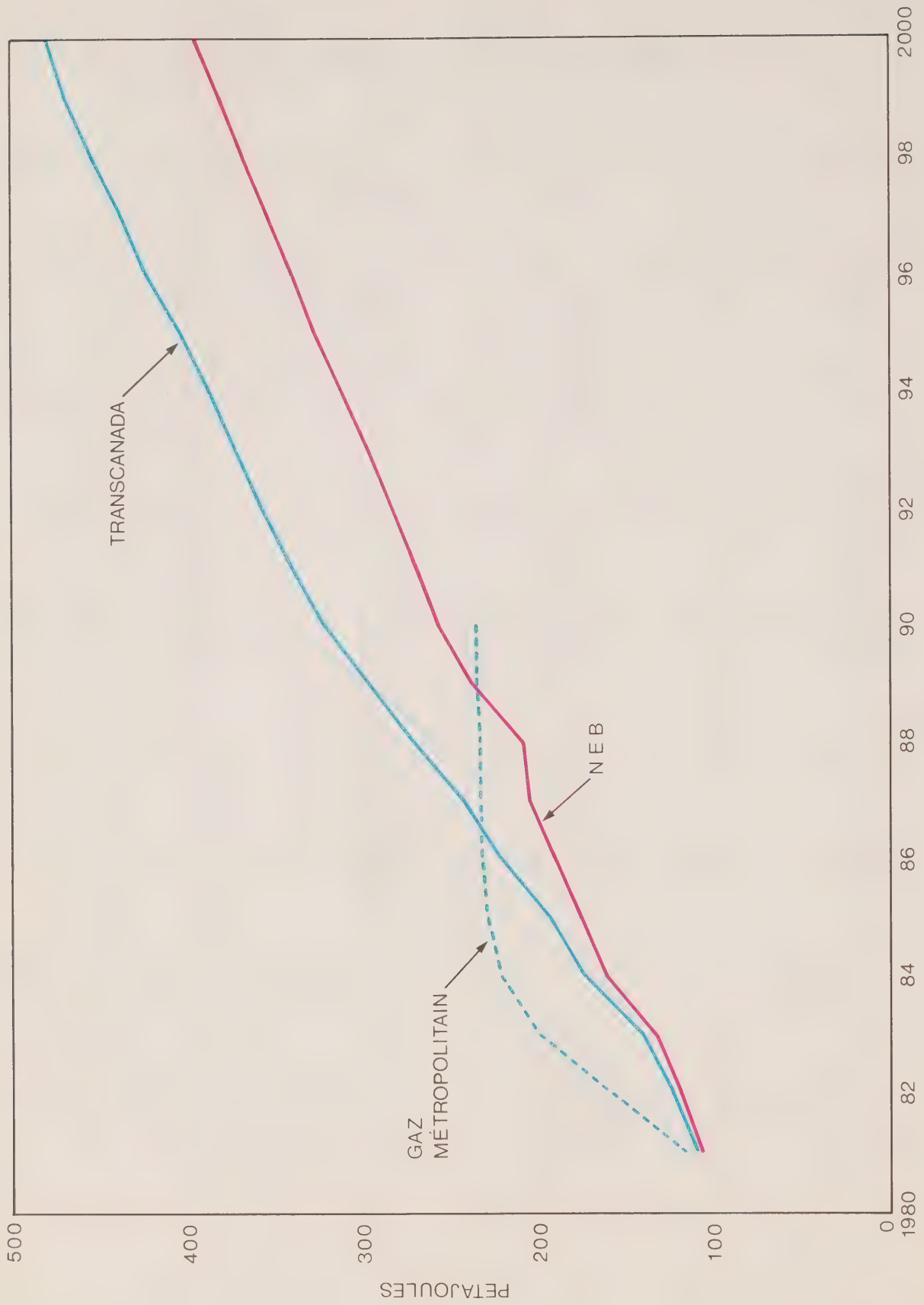
Table 4-1

NET SALES OF NATURAL GAS - QUEBEC

Comparison of Forecasts

(Petajoules)

	<u>TCPL</u>	<u>Gaz Métro</u>	<u>NEB</u>
<u>Residential</u>			
1981	17.9	18.8	20.0
1982	19.5	23.7	23.0
1985	31.8	43.1	36.7
1990	61.3	51.4	55.9
1995	82.9	—	71.3
2000	102.6	—	78.0
<u>Commercial</u>			
1981	14.8	19.4	16.8
1982	16.3	27.1	17.3
1985	28.2	38.1	25.2
1990	52.7	40.0	51.7
1995	64.3	—	78.6
2000	72.6	—	104.5
<u>Industrial</u>			
1981	77.4	79.0	69.8
1982	89.9	110.4	79.4
1985	135.3	148.3	114.0
1990	209.6	143.7	150.0
1995	258.1	—	177.1
2000	306.2	—	214.8
<u>Total Net Sales</u>			
1981	110.1	117.2	106.6
1982	125.7	161.2	119.7
1985	195.3	229.5	175.9
1990	323.6	235.1	257.6
1995	405.3	—	327.0
2000	481.4	—	397.3



**NET SALES OF NATURAL GAS - QUEBEC**  
Comparison of Forecasts

Table 4-2

NET SALES OF NATURAL GAS - QUEBEC EXTENSION AREA

Comparison of Forecasts

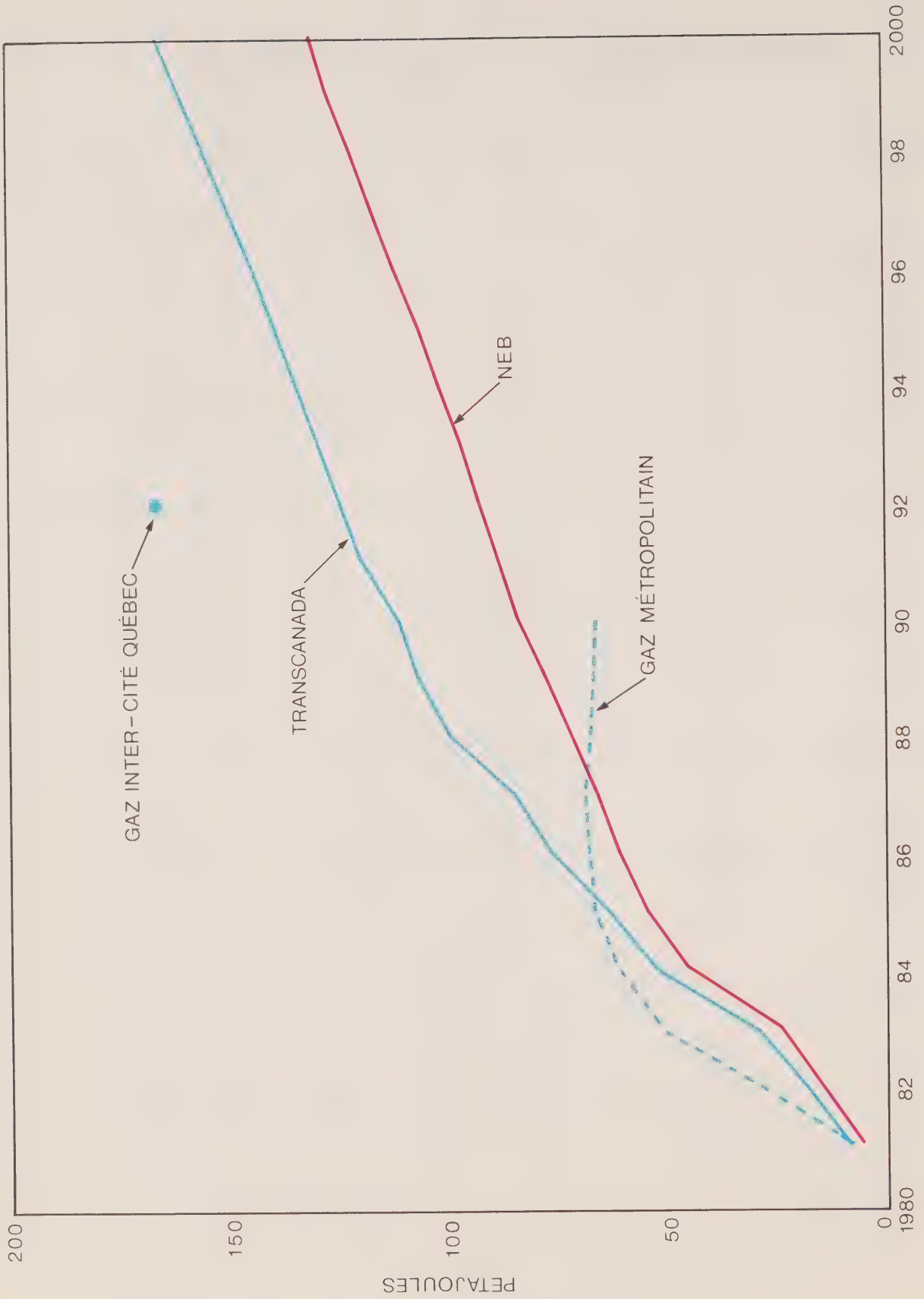
(Petajoules)

	<u>TCPL</u>	<u>Gaz Métro</u>	<u>Gaz Inter-Cité</u>	<u>NEB</u>
<u>Residential</u>				
1981	—	0.4	—	—
1982	0.5	1.5	—	0.7
1985	4.4	7.2	—	6.4
1990	13.8	10.8	27.6*	15.0
1995	21.7	—	—	21.9
2000	29.1	—	—	26.3
<u>Commercial</u>				
1981	—	0.8	—	—
1982	0.5	2.8	—	0.4
1985	3.9	7.2	—	3.3
1990	7.4	7.6	45.8*	9.2
1995	10.5	—	—	14.4
2000	13.5	—	—	20.4
<u>Industrial</u>				
1981	7.8	5.8	—	6.5
1982	17.1	24.5	—	14.3
1985	55.2	51.9	—	46.2
1990	89.3	48.1	93.2*	60.1
1995	107.3	—	—	70.8
2000	123.7	—	—	85.3
<u>Total Net Sales</u>				
1981	7.8	7.0	—	6.5
1982	18.1	28.8	—	15.4
1985	63.5	66.3	—	55.9
1990	110.5	66.5	166.6*	84.3
1995	139.5	—	—	107.1
2000	166.3	—	—	132.0

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\* Tenth year of service forecast.

Figure 4-2



NET SALES OF NATURAL GAS QUEBEC EXTENSION AREA  
Excluding Montreal  
Comparison of Forecasts



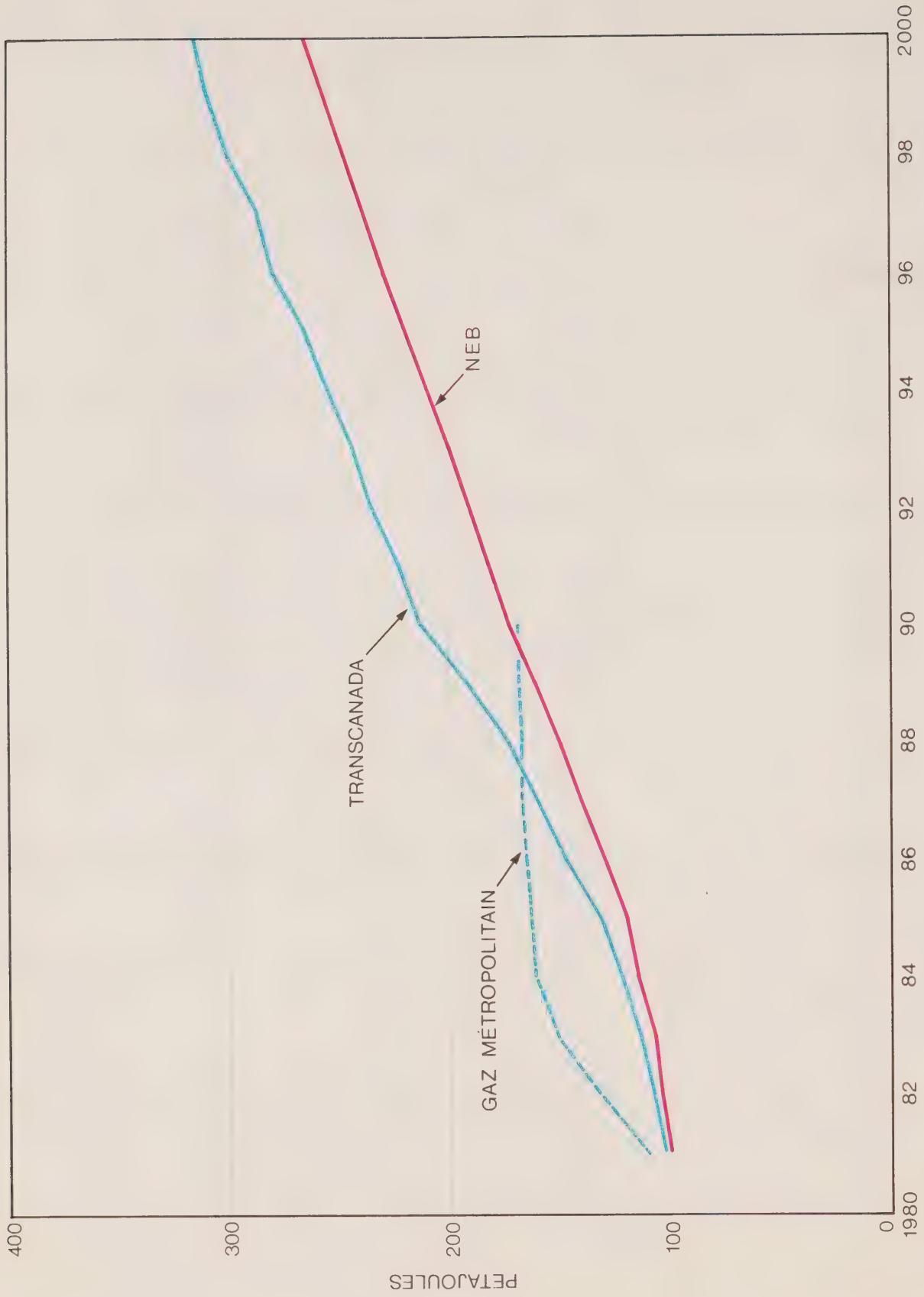
Table 4-3

NET SALES OF NATURAL GAS - MONTREAL

Comparison of Forecasts

(Petajoules)

	<u>TCPL</u>	<u>Gaz Métro</u>	<u>NEB</u>
<u>Residential</u>			
1981	17.9	18.4	20.0
1982	19.0	22.1	22.3
1985	27.4	36.0	30.3
1990	47.5	40.6	40.9
1995	61.2	—	49.4
2000	73.5	—	51.8
<u>Commercial</u>			
1981	14.8	18.6	16.8
1982	15.8	24.2	16.9
1985	24.3	30.9	21.9
1990	45.3	32.5	42.5
1995	53.8	—	64.1
2000	59.1	—	84.2
<u>Industrial</u>			
1981	69.6	73.2	63.3
1982	72.8	86.1	65.1
1985	80.2	96.4	67.8
1990	120.2	95.7	89.9
1995	150.8	—	106.3
2000	182.4	—	129.5
<u>Total Net Sales</u>			
1981	102.3	110.2	100.1
1982	107.6	132.4	104.3
1985	131.9	163.3	120.0
1990	213.0	168.8	173.3
1995	265.8	—	219.8
2000	315.0	—	265.5



**NET SALES OF NATURAL GAS - MONTREAL**  
Comparison of Forecasts

Table 4-4

NET SALES OF NATURAL GAS - TOTAL MARKET EXPANSION IN QUEBEC

Comparison of Forecasts

(Petajoules)

	<u>TCPL</u>	<u>Gaz Métro</u>	<u>Gulf</u>	<u>NEB</u>
<u>Residential</u>				
1981	—	1.7	4.2	0.1
1982	1.6	6.6	9.3	2.7
1985	9.7	26.0	15.8	15.4
1990	38.1	34.4	21.5	32.9
1995	59.7	—	25.0	45.8
2000	78.4	—	27.7	50.1
<u>Commercial</u>				
1981	1.1	3.2	1.2	1.2
1982	1.6	10.8	2.3	1.6
1985	10.2	21.8	10.4	10.1
1990	33.7	23.7	15.8	33.0
1995	44.3	—	18.9	54.0
2000	52.5	—	22.7	69.7
<u>Industrial</u>				
1981	7.8	11.1	3.1	6.5
1982	18.1	42.6	7.0	15.2
1985	57.3	80.4	20.0	47.8
1990	111.5	75.8	68.1	79.0
1995	142.1	—	72.0	96.5
2000	165.9	—	76.2	119.7
<u>Total Net Sales</u>				
1981	8.9	16.0	8.5	7.8
1982	21.3	60.0	18.6	19.5
1985	77.2	128.2	46.2	73.3
1990	183.3	133.9	105.4	144.9
1995	246.1	—	115.9	196.3
2000	296.8	—	126.6	239.5

Table 4-5

DISPLACEMENT OF ENERGY AS A RESULT OF NATURAL GAS MARKET EXPANSION

QUEBEC

NEB Forecast

(Petajoules)

	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Electricity	6.2	15.5	25.9	35.5
Light Fuel Oil	13.1	33.1	48.1	54.1
Heavy Fuel Oil	51.4	90.4	113.7	139.5
TOTAL	70.7	139.0	187.7	229.1

Table 4-6

NET SALES OF NATURAL GAS - QUEBEC EXTENSION MARKET

Range of NEB Forecasts

(Petajoules)

	<u>1981</u>	<u>1982</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Low Demand	6.5	15.3	54.1	75.6	87.2	96.0
Medium Demand	6.5	15.4	55.9	84.3	107.1	132.0
High Demand	6.6	16.0	61.7	105.1	152.3	222.3



Table 4-7

NET SALES OF NATURAL GAS - NEW BRUNSWICK

Comparison of Forecasts

(Petajoules)

	<u>Q &amp; M</u>	<u>Inter-City Gas</u>	<u>NEB</u>
<u>Residential</u>			
1982	0.1	—	0.1
1985	1.6	—	3.2
1990	3.9	—	5.1
1995	6.2	—	6.0
2000	8.5	—	6.7
<u>Commercial</u>			
1982	0.1	—	0.1
1985	1.2	—	2.4
1990	2.7	—	3.7
1995	4.3	—	4.5
2000	6.0	—	5.7
<u>Industrial</u>			
1982	0.4	—	0.3
1985	5.5	—	6.7
1990	12.2	—	12.2
1995	20.7	—	17.4
2000	25.5	—	20.2
<u>Thermal</u>			
1982	—	17.2 <sup>(1)</sup>	—
1985	—	17.2 <sup>(2)</sup>	—
1990	—	17.2 <sup>(3)</sup>	—
1995	—	—	—
2000	—	—	—
<u>Total Net Sales</u>			
1982	0.6	47.8 <sup>(1)</sup>	0.5
1985	8.3	59.3 <sup>(2)</sup>	12.3
1990	18.8	61.7 <sup>(3)</sup>	21.0
1995	31.2	—	27.9
2000	40.0	—	32.6

(1) Second year of service.

(2) Sixth year of service.

(3) Tenth year of service.

Table 4-8

NET SALES OF NATURAL GAS - NOVA SCOTIA

Comparison of Forecasts

(Petajoules)

	<u>Q &amp; M</u>	<u>Nova Scotia</u>	<u>Symborski Base</u>	<u>Symborski Alternative</u>	<u>Inter-City Gas</u>	<u>NEB</u>
<u>Residential</u>						
1982	0.1	0.8	—	—	—	0.1
1985	1.7	2.0	2.0	6.7	—	3.8
1990	4.3	3.9	4.0	10.9	—	5.7
1995	6.7	5.7	6.0	13.4	—	6.6
2000	9.3	7.5	8.5	15.8	—	7.3
<u>Commercial</u>						
1982	0.1	0.1	—	—	—	0.2
1985	1.2	3.9	1.1	4.2	—	3.5
1990	3.1	7.6	4.1	7.6	—	5.1
1995	4.7	11.3	7.6	10.7	—	6.1
2000	6.5	15.3	13.3	13.3	—	7.5
<u>Industrial</u>						
1982	0.1	1.1	—	—	—	0.2
1985	2.8	10.2	13.7	13.7	—	4.9
1990	6.6	11.3	15.9	15.9	—	8.9
1995	11.3	12.5	18.5	18.5	—	12.7
2000	13.9	13.9	21.4	21.4	—	14.7
<u>Thermal</u>						
1982	3.2	26.0	—	—	19.0 <sup>(1)</sup>	5.1
1985	18.6	27.2	21.7	21.7	19.0 <sup>(2)</sup>	24.8
1990	11.9	1.9	13.3	13.3	19.0 <sup>(3)</sup>	1.9
1995	13.2	0.7	12.9	12.9	—	0.7
2000	16.7	0.7	13.3	13.3	—	0.7
<u>Total Net Sales</u>						
1982	3.5	28.0	—	—	36.1 <sup>(1)</sup>	5.6
1985	24.3	43.3	38.5	46.3	46.2 <sup>(2)</sup>	37.0
1990	25.9	24.7	37.3	47.7	48.1 <sup>(3)</sup>	21.6
1995	35.9	30.2	45.0	55.5	—	26.1
2000	46.4	37.4	56.5	63.8	—	30.2

(1) Second year of service.

(2) Sixth year of service.

(3) Tenth year of service.

Table 4-9

NATURAL GAS FOR THERMAL GENERATION AND STEAM PRODUCTION IN NOVA SCOTIA

NEB Forecast

(Petajoules)

	<u>Thermal Generation</u> (1)	<u>Steam Production</u> (2)	<u>Total</u> (3)
1982	3.0	2.1	5.1
1983	16.5	10.5	27.0
1984	17.1	10.5	27.6
1985	14.2	10.5	24.8
1986	13.6	10.5	24.2
1987	4.5	10.5	15.1
1988	1.6	—	1.6
1989	1.5	—	1.5
1990	1.9	—	1.9
1991	2.1	—	2.1
1992	0.9	—	0.9
1993	1.4	—	1.4
1994	1.2	—	1.2
1995	0.7	—	0.7
1996	0.7	—	0.7
1997	0.7	—	0.7
1998	0.7	—	0.7
1999	0.7	—	0.7
2000	0.7	—	0.7

Notes:

- (1) Assumes existing thermal plants converted to coal by 1988.
- (2) Tupper No. 1 steam production for the Port Hawkesbury heavy water plant.
- (3) Assumes that natural gas delivery will start on November 1, 1982.

Totals might not add due to rounding.

Table 4-10

NET SALES OF NATURAL GAS - NEW BRUNSWICK AND NOVA SCOTIA

Comparison of Forecasts

(Petajoules)

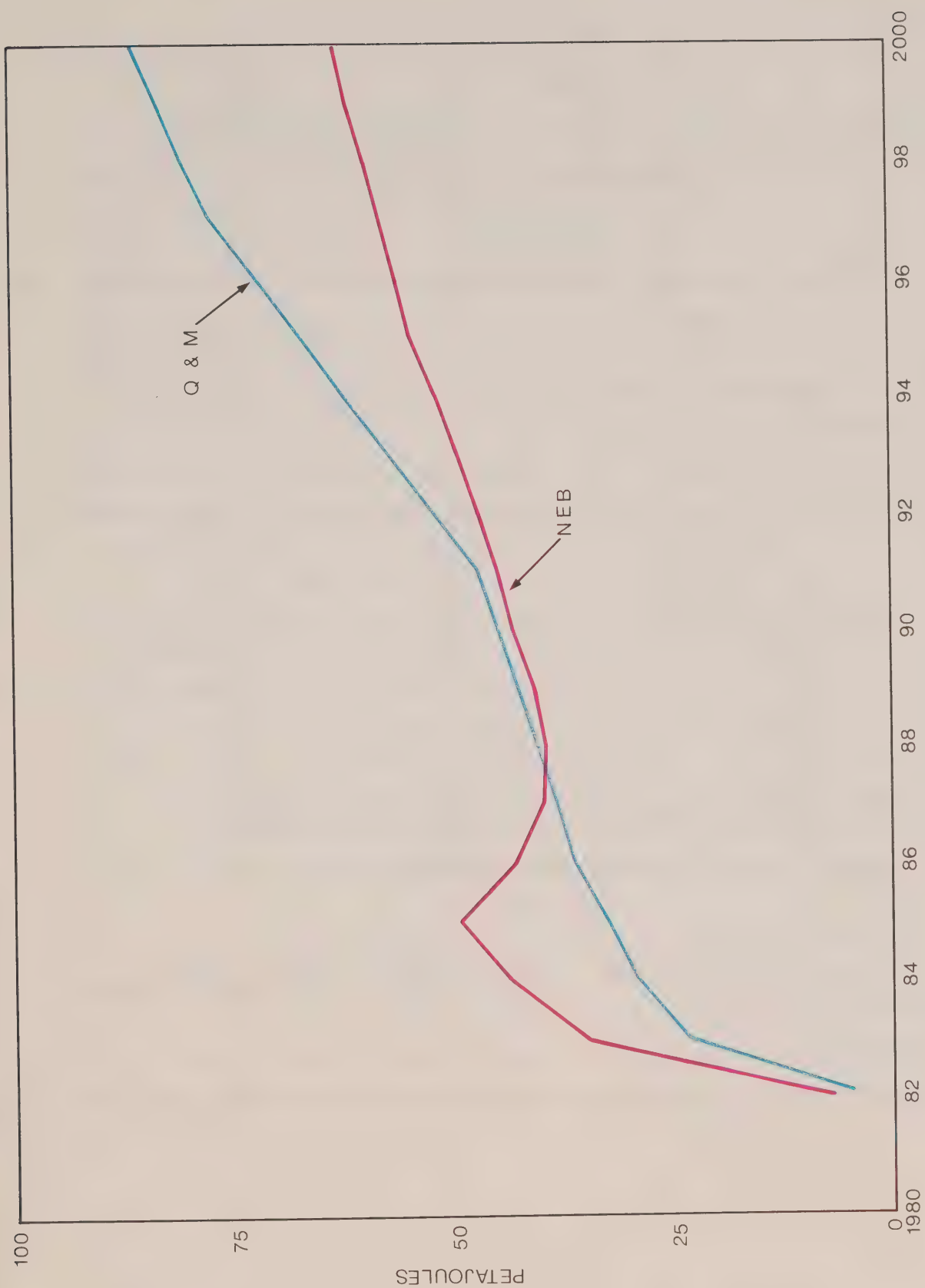
	<u>Q &amp; M</u>	<u>Inter-City Gas</u>	<u>NEB</u>
<u>Residential</u>			
1982	0.2	—	0.2
1985	3.3	—	7.0
1990	8.2	—	10.8
1995	13.0	—	12.7
2000	17.7	—	14.0
<u>Commercial</u>			
1982	0.1	—	0.3
1985	2.3	—	5.9
1990	5.8	—	8.8
1995	9.2	—	10.7
2000	12.4	—	13.2
<u>Industrial</u>			
1982	0.4	—	0.5
1985	8.3	—	11.6
1990	18.9	—	21.2
1995	32.0	—	30.1
2000	39.4	—	35.0
<u>Thermal</u>			
1982	3.2	36.1 <sup>(1)</sup>	5.1
1985	18.6	36.1 <sup>(2)</sup>	24.8
1990	11.9	36.1 <sup>(3)</sup>	1.9
1995	13.2	—	0.7
2000	16.7	—	0.7
<u>Total Net Sales</u>			
1982	3.9	83.8 <sup>(1)</sup>	6.1
1985	32.5	105.6 <sup>(2)</sup>	49.3
1990	44.8	109.8 <sup>(3)</sup>	42.7
1995	67.4	—	54.2
2000	86.2	—	62.9

(1). Second year of service.

(2) Sixth year of service.

(3) Tenth year of service.





**NET SALES OF NATURAL GAS - NEW BRUNSWICK AND NOVA SCOTIA**  
Comparison of Forecasts

Table 4-11

DISPLACEMENT OF ENERGY AS A RESULT OF NATURAL GAS MARKET EXPANSION

NEW BRUNSWICK & NOVA SCOTIA

NEB Forecast

(Petajoules)

	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Electricity	1.1	1.9	2.5	3.5
Light Fuel Oil	8.2	12.6	15.0	17.0
Heavy Fuel Oil	39.3	27.3	35.5	41.2
TOTAL	48.6	41.8	53.0	61.7

Table 4-12

NET SALES OF NATURAL GAS - NEW BRUNSWICK & NOVA SCOTIA

Range of NEB Forecasts

(Petajoules)

	<u>1982</u>	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
Low Demand	6.1	49.0	40.2	47.6	50.9
Medium Demand	6.1	49.3	42.7	54.2	62.9
High Demand	6.1	51.9	51.8	73.1	96.6

CHAPTER 5  
NATURAL GAS SUPPLY

5.1 TransCanada

5.1.1. Evidence of the Applicant

TransCanada's supply and capability evidence was essentially unchanged from that submitted at the Licence Phase of the hearing. However, TransCanada revised its estimate of remaining reserves under contract upward to 30.39 EJ as of 31 December 1978, compared with the 28.63 EJ in its previous submission to the Licence Phase. This improvement was due mainly to increases in the Elmworth, Goodfare, and Suffield areas in the Province of Alberta.

AERCB had recently issued an amendment to TransCanada's AERCB permit No. TC 79-12. This authorization granted in full the amendments requested by TransCanada in its application to AERCB for an increase of some 235 PJ. In total, as of 31 December 1978, the Company had some 20.8 EJ remaining under both its own and other removal permits.

TransCanada submitted a deliverability forecast based on producer data and on TransCanada's observation of actual performance at the various gas collection points. TransCanada also submitted a supply-demand balance for the period 1981 to 1990, which demonstrated that a supply deficiency from contracted reserves would occur in 1986. It was confident that there was sufficient gas available for contracting in Alberta to make up any deficiency that might arise. TransCanada estimated that when trend additions were included in the supply-demand balance, there would be no deficiency in gas supply in the forecast period.

TransCanada indicated that it had adequate supply for its proposed markets in Quebec and for those of Q & M in the Maritimes and would like to be the primary supplier for both. It stated that Pan-Alberta and TransCanada could share in supplying the markets under the joint venture proposal, but, until an agreement was reached, it would remain responsible for supplying all volumes for Quebec.

### 5.1.2 Views of the Board

The Board has not changed its forecast of TransCanada's total deliverability from established reserves as shown in the Licence Phase Report. The Board indicated in that report that TCPL could meet all its requirements, including all eastern expansion markets, until 1985.

The Board is satisfied that TransCanada will be able to contract for more gas in Alberta to make up any deficiency that may occur.

## 5.2 Q & M

### 5.2.1 Evidence of the Applicant

Pan-Alberta, on behalf on Q & M, adopted the supply evidence it had submitted at the Licence Phase of the hearing. Pan-Alberta indicated that it had under contract remaining proven and probable reserves of 6.6 EJ and 2.5 EJ respectively, which included reserves dedicated to Sulpetro. It was confident that sufficient gas would be available under its various deliverability contracts to satisfy both its recently authorized new exports and the Q & M requirements.

Pan-Alberta testified it held AERCB Permit No. PA 74-1, authorizing it to remove 1.1 EJ during the period 1 November 1974 to 31 October 1989 and Permit No. PA 79-2 issued on 6 September 1979 for removal of 3.7 EJ over the period 1 November 1980 to 31 October 1995.

Pan-Alberta stated it had also applied to the AERCB for a permit to remove an additional 4.7 EJ from the province during the period 1 November 1980 to 31 October 1995. These quantities would be used to help fulfill its obligations to Northern Border, as well as to obviate the necessity for TCPL's supply backstop commitment of 746.7 PJ. The remaining quantities would be dedicated to Q & M and other new markets.

In the Licence Phase of the hearing, Pan-Alberta submitted a supply-requirements forecast for an expanded case, which reflected all its potential requirements for Canadian markets (including Q & M) and for exports proposed to be made through prebuilt sections of the Foothills (Yukon) pipeline. The supply included its contracted quantities under AERCB Permit Nos. PA 74-1 and PA 79-2 and supply from Alberta and Southern, but it did not include the proposed purchase of 746.7 PJ from



TransCanada. Pan-Alberta demonstrated that supply was adequate to meet demand for five years before a deficiency occurred in the 1985-86 contract year. It was confident that sufficient gas was available not only for its export commitments but also for the requirements of Q & M. The Company also stated that it had confidence in its ability to purchase additional gas from other purchasers.

Under the proposed joint venture, both Pan-Alberta and TCPL indicated that either would be able to contract necessary quantities for the overall project. Although Pan-Alberta and TCPL had no agreement on the specific sharing of supply for the total project, they indicated this would be agreed upon in due course. Until such an agreement is completed, TCPL would remain responsible for supply for Quebec markets and Q & M for the Maritimes.

#### 5.2.2 Views of the Board

In the Licence Phase Report, the Board concluded that Pan-Alberta had sufficient supply available to it to meet its applied-for export requirements, including fuel requirements, until 1985. Although the Board did not include the possible Q & M portion of the eastern expansion markets in terms of Pan-Alberta's supply capability, it did make full allowance for these requirements as a demand on the TransCanada system.

With respect to the proposed export case, Q & M relied on the evidence presented by Pan-Alberta, whose supply/demand forecast, however, included no allowance for Q & M's export component. There was, therefore, no evidence provided to the Board on the availability of supply for the proposed export volumes under Q & M's export case.



## CHAPTER 6

### ENGINEERING, RIGHT-OF-WAY AND ENVIRONMENTAL MATTERS

#### 6.1 TransCanada

##### 6.1.1 Location

##### 6.1.1.1 Introduction

The proposed TCPL pipeline system in Quebec consists of a mainline between St-Lazare and Lévis/Lauzon, sixty-two laterals and sub-laterals, and seven compressor stations. The general locations of these facilities are shown in Figure 6-1 in Appendix 6 and details are provided in Tables 6-2, 6-3, and 6-4, and in a later section of this report.

##### 6.1.1.2 Route Selection

TCPL stated that the objective of its proposal was to serve the major populated areas of Quebec with a minimum amount of facilities subject to engineering and environmental constraints. In selecting its route, it had sought to utilize, where possible, existing transportation corridors.

After conducting studies of the main market areas and consulting topographical, geological and Canada Land Inventory maps, as well as performing aerial and environmental surveys, a route within 1.93 km on either side of the centre line of a pipeline corridor was selected from various alternatives.

After the preliminary route selection, TCPL conducted a geotechnical evaluation, a preliminary analysis of some river crossings, an investigation of construction-related problems and environmental studies of the pipeline. TCPL stated that it had held discussions with various local, municipal, regional and provincial authorities in order to incorporate their views into the selection of the mainline routing.

Laterals and sub-laterals were selected on the basis of an "order of profitability" study, which estimated the revenues and costs of serving potential markets in the vicinity of the mainline.

UPA recommended that both the Province of Quebec and the operating company discuss the final selection of the route with UPA members before the pipeline is constructed. It also suggested the possibility of relocating the pipeline within the rights-of-way of

existing highways, such as autoroutes 640, 40 and 20 to avoid crossing agricultural lands.

TransCanada stated that it preferred to go alongside the public utility corridors rather than share them. TransCanada, however, in its final argument, has committed to do whatever was appropriate in its final design to alleviate UPA's concerns, while taking account of certain important constraints such as highway interchanges and width necessary for a pipeline right-of-way, etc.

#### 6.1.1.3 Alternative Routes

TCPL considered several alternative mainline routes, such as from St-André Est to Lachute and following the Rivière du Nord toward St-Jérôme and rejoining the prime route at the Rivière de l'Achigan, following the Interprovincial pipeline at Mascouche with three alternate branchings from that point and rejoining the prime route at Berthierville.

South versus North Shore routing along the St. Lawrence River between Trois-Rivières and Quebec City, and east versus west of Laurentides Park to Lac St-Jean were also considered and are discussed in later sections of this chapter.

Eastern Townships route alternatives included a route following the existing TCPL line southeast, crossing the Richelieu River south of St-Jean and from this point northeast to St-Césaire rejoining the prime route.

An alternative to the northern branch would leave the prime route between Rougemont and the Yamaska River passing near St-Hyacinthe, and continuing to Drummondville.

#### 6.1.1.4 Controversial Issues

Certain portions of TCPL's pipeline such as the Thurso lateral, the South Shore mainline from Trois-Rivières to Quebec City, the St-Flavien lateral and the Lac St-Jean/Saguenay lateral were subjected to detailed examination during the hearing.

The following sections summarize these issues.

#### 6.1.1.5 Thurso Lateral

TransCanada proposed to serve the Town of Thurso, Quebec, which is situated approximately 50 km northeast of Ottawa on the north shore of the Ottawa River.



The Thurso lateral would provide service to four load centres. The forecast demand for gas for the years 1982, 1990 and 2000 for the lateral is illustrated in Table 6-1.

Table 6-1

TRANSCANADA

FORECAST DEMAND FOR NATURAL GAS FOR THURSO LATERAL

( $10^6 \text{m}^3/\text{yr.}$ )

<u>Location</u>	<u>1982</u>	<u>1990</u>	<u>2000</u>
Lachute/Brownsburg	3.8	17.2	28.1
Marelan	-	17.0	22.9
Plaisance	-	0.5	0.9
Thurso	-	48.0	65.5
TOTAL	3.8	82.7	117.4

The towns of Lachute, Brownsburg and Marelan are located near the beginning of the lateral while Thurso and Plaisance are at the far end, with a distance of approximately 58 km separating Marelan and Thurso. The capital cost of serving Lachute, Brownsburg and Marelan was estimated to be approximately \$3.8 million (1979 dollars) and the additional capital cost to Thurso would be in the order of \$4.7 million (1979 dollars) totalling \$8.5 million.

TCPL had not made a detailed study to determine whether it would be more economical to serve Thurso from Ottawa and then serve Lachute and Marelan from its proposed lateral north of Montreal. Similarly, TCPL had not completed its detailed study to establish the economics of serving Thurso from the proposed North Bay shortcut.

TCPL suggested that approval of the lateral from Marelan to Thurso should be conditional on the filing of further information prior to construction, and that economic studies of this section would be provided at the time of filing of a North Bay shortcut application or some alternative application.

#### 6.1.1.6 North Shore versus South Shore from Trois-Rivières to Quebec City

TCPL proposed to construct its pipeline from Trois-Rivières to Quebec City along the South Shore of the St. Lawrence.

The proposed South Shore route would require a mainline crossing of the St. Lawrence river at Trois-Rivières and another St. Lawrence river crossing at St. Nicolas for the Quebec City and Chicoutimi lateral. Before the amendment of its application to make it complementary with that of TransCanada, Q & M proposed a North Shore route which would have required a St. Lawrence river crossing at Trois-Rivières for the Eastern Townships lateral and another St. Lawrence River crossing for its mainline at Quebec City to serve Lévis/Lauzon and the Maritimes.

TCPL witnesses testified during the hearing that both routes were feasible from engineering and construction standpoints, but opted for the South Shore alternative because of certain advantages. The main advantages mentioned were that:

- (1) it would avoid difficult crossings of tributaries which flow into the St. Lawrence from the North, thereby reducing the threat of river bank erosion,
- (2) it would facilitate the ditching operation during construction, as the terrain of South Shore route consists of considerably less bedrock than does the terrain of the North Shore route, and
- (3) it would provide service from the mainline to Bécancour and Nicolet which otherwise would have to be provided from an extension of the Eastern Townships pipeline at an extra cost of \$4.2 million.

Q & M had also stated that both routes were feasible although it said that its originally proposed North Shore route was preferable. Among its stated advantages were:

- (1) the mainline would cross the St. Lawrence only once,
- (2) there would be a saving of six million dollars over the South Shore routing,
- (3) the terrain of the North Shore route consists of bedrock and provides more stable ground and less erosion disturbance and sediment problems,
- (4) the construction schedule would more likely be met by the North Shore route, while the effects of wet weather and problems with numerous farmers in the agricultural areas on the South Shore would likely cause delays, and

- (5) it would be possible to provide service to intermediate centres such as Portneuf, St-Basile and Donnacona.

The Province of Quebec indicated a preference for the South Shore route.

6.1.1.7 Gathering of St-Flavien and Other Gas Reserves

TCPL proposed to build a 10.5 km lateral of 114.3 mm O.D. pipe in 1981 to connect with St-Flavien gas reserves. The capital cost of this connection amounted to \$712,000 in 1979 dollars.

Quebec stressed the unique opportunity of providing a tie-in for the gas reserves found by SOQUIP near St-Flavien, a small community situated southwest of Quebec City.

Based on data submitted by TCPL, the production forecasted for the St-Flavien gas fields was estimated to be  $28 \times 10^3 \text{ m}^3$  per day.

Quebec confirmed that this flow was in agreement with SOQUIP's forecast, but could not confirm whether the gas would be available on a commercial basis in 1981. Quebec also indicated that additional gas reserves were likely to be found on the South Shore of the St. Lawrence River, mainly between Trois-Rivières and Quebec City.

6.1.1.8 East Versus West of Laurentides Provincial Park to Serve the Saguenay/Lac St-Jean Region

The siting of the lateral to serve the Saguenay/Lac St-Jean area was subject to considerable cross-examination during the hearing. The following summarizes the major views.

TransCanada proposed to run a lateral bypassing the Laurentides Provincial Park northeast of Quebec City up to Baie St-Paul, then going northward paralleling the eastern boundary of the park as far as Chicoutimi. From here, the Saguenay/Lac St-Jean area would be served to the west as far as Dolbeau.

TCPL examined an alternative west of the Laurentides Provincial Park from the proposed Shawinigan/Grand'Mère lateral, running northward to the CN railway and paralleling this railway up to La Tuque and then paralleling Highway 155 to Chambord. The same markets would be served in the Saguenay/Lac St-Jean region.

The western route would serve La Tuque, representing a market of  $97 \times 10^6 \text{ m}^3$  in 1990, but would not service Beaupré, Baie St-Paul and Clermont, where the total demand forecast in 1990 is  $102 \times 10^6 \text{ m}^3$ .

TCPL stated that an eastern route would open the possibility of developing future markets on the North Shore of the St. Lawrence River up to Sept-Iles. Potential markets in the lower part of the Saguenay region could also be served in the long term.

TCPL also indicated that the eastern route would allow for two sub-laterals to Quebec City, in order to minimize the facilities to be constructed by the distribution company.

Prior to the application being amended and made complementary, Q & M had stated that, should the eastern route be retained, part of the pipeline right-of-way would be located in narrow and mountainous areas. Furthermore, the pipeline would cross the built-up metropolitan Quebec City area and extensive rock blasting operations would be required between Quebec City and Beaupré, in some cases, very close to residential areas. It proposed that the pipeline be constructed along the western route.

Quebec supported the eastern route because Baie St-Paul and Clermont would then be serviced and also because there would exist the possibility of serving Sept-Iles if such a lateral from the eastern route became economical.

Since the two issues of east versus west of the Laurentides Park and North Shore versus South Shore from Trois-Rivières to Quebec City were closely interrelated, the Board requested TCPL to provide a consolidated study of the best options. This study showed that the cost of service and cost of facilities were essentially the same for serving Lac St-Jean from near Trois-Rivières or from Quebec City, given a North Shore and a South Shore routing respectively, between Trois-Rivières and Quebec City.

#### 6.1.1.9 Views of the Board

The Board notes that, except for UPA's intervention, TCPL's prime route and Eastern Townships system location were not challenged during the hearing.



The Board recognizes that TCPL will consider in its final design certain deviations of its proposed pipeline route to allow it to share corridors with other public utilities. These deviations will be subject to negotiations with parties concerned and will require final approval by the Board. In approving such deviations, the Board will consider the reduced impact on the agricultural or privately owned land, the additional cost of the alternatives, the safety of the public and the problems associated with construction, operation and maintenance of the pipeline.

The Board has reached the following conclusions with respect to specific issues:

- (a) With regard to the Thurso lateral, the Board finds that TCPL has not adequately established the need for supplying the Thurso area with gas by means of a lateral from its proposed system, particularly in view of possibly more economical means of supply from the contemplated North Bay to Montreal "short-cut" or from the existing Ottawa lateral. The Board, therefore, does not approve the Thurso lateral beyond Marelán, and agrees with TCPL that consideration regarding the Marelán-Thurso section of the lateral requires further study of a possible lateral from Ottawa or from the North Bay shortcut.
- (b) As to the alternative route along the North Shore, between Trois-Rivières and Quebec City, the Board is of the opinion that both North Shore and South Shore routes are technically and economically feasible, and accepts TCPL's proposal of the South Shore route.
- (c) With respect to the proposed lateral to connect with St-Flavien gas reserves, the Board estimates that the marginal cost of service of this line would be approximately \$17 per  $10^3 \text{m}^3$  in the first year of availability of the gas, in terms of 1979 dollars. Since the estimated cost of service of this lateral will be lower than the existing cost of service to

transmit Alberta gas on the TCPL mainline from Burstall to Montreal, the Board concludes that the construction of this lateral could be economically justified. However, before this loop would be built, the Board would require copies of the gas supply contracts with SOQUIP.

- (d) Concerning the best route to serve Saguenay/Lac St-Jean, the evidence submitted by TCPL demonstrates that the cost of service and cost of facilities of the eastern and western routes around the Laurentides Park are essentially equivalent. Furthermore, since the intermediate market requirements for La Tuque in the case of the western route, and for Beaupré, Baie St Paul and Clermont in the case of the eastern route are approximately the same, the Board does not consider them to be a determinant factor in the route selection. The Board accepts TCPL's proposed eastern route selection.

In regard to the alternative routes, the Board is satisfied that they were properly considered by the Applicant in selecting its mainline, lateral, and sub-lateral locations.

#### 6.1.2 Design and Capacity

##### 6.1.2.1 Design Methodology

TCPL adopted the principle that its mainline designs for the export and non-export cases would satisfy the larger of two gas demand forecasts both calculated on the basis of the level of demand for the year 1989-90. These requirements are:

- (1) the peak winter day in Quebec plus the design winter day in the Maritimes, and
- (2) the average winter day in Quebec plus the average winter day in the Maritimes.

The mainline from St-Lazare to Lévis/Lauzon in Quebec was designed with suitable pipe sizes and operating pressures for the export (see Table 6-2), non-export (see Table 6-3) and Quebec-only (see Table 6-4) cases. The mainline design in the above cases did not take into

account the gas potentially available from underground storage in New Brunswick. For each of the cases, TCPL presented an economic study indicating that the selected designs were superior to alternative designs on the basis of both capital cost and cost of service.

TCPL's design of lateral and sub-lateral lines was identical for the export, non-export and Quebec-only cases. The design criteria were:

- (1) the forecasted 1989-90 peak daily flow,
- (2) a minimum delivery pressure of 2 760 kPa (gauge) for all sales points, and
- (3) a minimum pipe size of 114.3 mm.

In total some 1 340 km of laterals and sub-laterals with pipe sizes ranging from 114.3 mm to 508.0 mm, were contained in the proposed design, as detailed in Table 6-5.

For the export case, TCPL proposed a total of seven compressor stations; four on the mainline and three on the laterals and sub-laterals, with a total of 54 867 kW in the operating year 1989-90.

TCPL proposed to install electric motor-driven compressor units in each station with the exception of the St-Lazare station, where three larger gas turbine units were selected on the basis of lower capital and fuel costs.

TCPL's design provided a standby compressor unit at each compressor station, except at the St-Césaire station. The size of the spare unit was designed to supply approximately 30 percent of total horsepower at each station. The installation of these units would ensure that there would be no reduction in peak day capacity even with a breakdown of the most critical unit on the system. In the event of pipeline breaks or power supply failure at a compressor station, the gas supply could be maintained by reversing the flow so that supply could be obtained from the planned underground storage in New Brunswick.

For the non-export case, TCPL proposed a total of seven compressor stations, with a total of 36 603 kW for the operating year

1989-90. Other design features for compressor stations would be much the same as those for the export case.

For the Quebec-only case, two compressor stations for the mainline would be required as well as three compressor stations for the laterals and sub-laterals for the operating year 1989-90. Other design features for compressor stations would be similar to those in the export case.

On the issue as to whether it would be necessary at this time to issue a certificate for compression facilities that are not planned to be constructed for seven or eight years in the future, TCPL suggested that it would be appropriate for the Board to condition the certificate for those compressor facilities in such a way that the design and cost information as well as the justification of the need for those based on market requirement would be filed with the Board prior to the construction.

#### 6.1.2.2 Geotechnical Design

In designing and estimating the cost of its pipeline, TCPL took account of terrain problems, soil-pipe interaction, and mitigative measures necessary to construct a safe and reliable pipeline. It identified, for instance, the areas of high water table where buoyancy control measures and drain tiles would be needed, and where construction schedules could be affected during prolonged wet weather conditions. It identified, also, the locations of substantial bedrock where extensive blasting and rock ditching would be required. Because unstable slopes could have a negative impact on the structural integrity of the pipeline, TCPL gave special consideration to slope protection and stabilization in areas of marine clays. Loss of pipe support due to erosion or buoyant uplift, for example, would result in bending stresses on the pipe spans between support points.

TCPL identified the seismic zones along its pipeline corridors. It testified that the combined effect of operating temperature differential and potential seismic loads in the Seismic Zone Three in some soils would impose some limitations on side bend angles, although the effect was not expected to be very significant.



Table 6-2

TCPL  
SUMMARY OF MAINLINE FACILITIES

Export Case

Section	Pipe Length (km)	Pipe Size (mm)	MOP kPa (gauge)	Compressor Station		No.	Compressor Station Unit		
				No.	Location		Type	Size (kW)	Year of Construction
St-Lazare to Boisbriand Jct.	39.9	864	7 070	1	St-Lazare	2	gas	8200	1981
								8200	1983
Boisbriand Jct. to St-Jérôme Jct.	3.0	660	7 070	1	St-Jérôme	1	electric	2982	1983
						1	electric	2982	1984
						1	electric	2982	1988
St-Jérôme Jct. to Trois-Rivières	132.6	660	8 270	1	Louiseville	2	electric	2982	1983
						1	electric	2982	1986
Trois-Rivières to St-Nicolas	105.3	660	8 270	1	St-Nicolas	2	electric	2609	1983
						1	electric	2609	1985
St-Nicolas to Lévis/Lauzon	53.4	610	8 270	-	-	-	-	-	-

Table 6-3

TCPL  
SUMMARY OF MAINLINE FACILITIES

Non-Export Case

Section	Pipe Length (km)	Pipe Size (mm)	MOP kPa (gauge)	Compressor Station		No.	Compressor Station Unit		
				No.	Location		Type	Size (kW)	Year of Construction
St-Lazare to Boisbriand Jct.	39.9	762	7 070	1	St-Lazare	2	gas	8200	1981
						1	gas	8200	1986
Boisbriand Jct. to St-Jérôme Jct.	3.0	610	7 070	-	-	-	-	-	-
St-Jérôme Jct. to Trois-Rivières	132.6	610	7 070	1	Crabtree	1	electric	1864	1987
Trois-Rivières to St-Nicolas	105.3	610	7 070	2	Bécancour	1	electric	1864	1985
					St-Nicolas	1	electric	1864	1986
						2	electric	1118	1983
St-Nicolas to Lévis/Lauzon	53.4	457	8 270	-	-	-	-	-	-

Table 6-4

TCPL  
SUMMARY OF MAINLINE FACILITIES

Quebec-Only Case

Section	Pipe Length (km)	Pipe Size (mm)	MOP kPa (gauge)	<u>Compressor Station</u>		<u>Compressor Station Unit</u>		
				<u>No.</u>	<u>Location</u>	<u>Type</u>	<u>Size (kW)</u>	<u>Year of Construction</u>
St-Lazare to Boisbriand Jct.	39.9	762	7 070	1	St-Lazare	gas	5591	1981
						gas	5591	1985
Boisbriand Jct. to St-Jérôme Jct.	3.0	610	7 070	-	-	-	-	-
St-Jérôme Jct. to Trois-Rivières	132.6	610	7 070	-	-	-	-	-
Trois-Rivières to St-Nicolas	105.3	610	7 070	1	Bécancour	electric	1118	1989

Table 6-5

TCPL

DESCRIPTION OF LATERALS AND SUB-LATERALS IN QUEBEC

<u>Area Served</u>	<u>Pipe Length</u> (km)	<u>Pipe Size</u> (mm)	<u>Construction</u> <u>Year</u>
Acton Vale	8.20	114.3	1982
Alma	34.44	219.1	1983
	0.96	114.3	1983
Asbestos	24.94	114.3	1983
Beauce	81.60	114.3	1983
Beauceville	0.32	114.3	1983
Bécancour	2.25	114.3	1981
Berthierville	3.68	114.3	1980
Boisbriand	14.00	508.0	1980
Bon Conseil	15.45	114.3	1983
Breakeyville	2.73	114.3	1981
Bromptonville	10.30	168.3	1982
Chicoutimi	207.45	323.9	1983
Clermont	40.23	168.3	1983
Cowansville	14.97	114.3	1982
Crabtree	2.41	114.3	1980
Desbiens	1.45	114.3	1983
Dolbeau	56.65	168.3	1984
Donncona	23.98	168.3	1981
Donohue	5.47	114.3	1984
Drummondville	107.35	168.3	1983
	6.28	114.3	1982
East Angus	20.28	168.3	1983
Farnham	14.48	273.1	1982
	13.36	114.3	1981
Granby	79.99	219.1	1982
	0.97	114.3	1982
Grand'Mère	6.44	114.3	1981



Table 6-5 (Continued)

DESCRIPTION OF LATERALS AND SUB-LATERALS IN QUEBEC

<u>Area Served</u>	<u>Pipe Length</u> (km)	<u>Pipe Size</u> (mm)	<u>Construction</u> <u>Year</u>
Jonqui�re	14.00	273.1	1983
Kingsey Falls	0.97	114.3	1983
Lachenaie	18.99	219.1	1980
Lachute	28.32	168.3	1981
	0.80	114.3	1981
L�vis/Lauzon	2.25	114.3	1982
Louiseville	1.13	114.3	1980
Magog	1.93	114.3	1982
Marbleton	18.35	114.3	1983
Marelan	0.96	114.3	1982
Mont-Rolland	23.17	114.3	1982
Nicolet	9.17	114.3	1981
Plaisance	0.48	114.3	1982
Quebec City	41.04	406.4	1981
Roberval	53.44	168.3	1983
	1.93	114.3	1983
Shawinigan	33.97	168.3	1981
Sherbrooke	1.45	114.3	1982
St-C�saire	43.93	323.9	1981
	4.67	273.1	1981
	17.38	219.1	1981
St-F�licien	4.18	114.3	1984
St-Flavien	10.46	114.3	1981
St-Germain	5.95	114.3	1982
St-Hyacinthe	39.76	219.1	1982
	12.71	114.3	1981
St-Jean	5.95	114.3	1981
St-J�r�me/Mirabel	9.17	219.1	1980
St-Joseph	1.77	114.3	1983

Table 6-5 (Continued)DESCRIPTION OF LATERALS AND SUB-LATERALS IN QUEBEC

<u>Area Served</u>	<u>Pipe Length</u> (km)	<u>Pipe Size</u> (mm)	<u>Construction</u> <u>Year</u>
Ste-Marie	2.09	114.3	1983
St-Mathieu	54.08	508.0	1984
Thurso	73.07	114.3	1982
Victoriaville	1.45	114.3	1983
Waterloo	<u>1.45</u>	114.3	1982
TOTAL	1 341.23		

#### 6.1.2.3 Materials Engineering

In its original design, TCPL prepared a stress analysis of the proposed pipeline based on the maximum allowable operating pressure of 7 070 kPa. As a result of the amendment to the application, in November 1979, new pipe sizes were introduced and the maximum allowable operating pressure was increased to 8 270 kPa. A preliminary stress analysis for new pipe sizes and increased maximum allowable operating pressure was undertaken by TCPL for the mainline and laterals. The preliminary results of this analysis indicated that there were no stress-related restrictions on the present design of the mainline. However, in areas of noncohesive soils there would be some restrictions for side bends on the lateral lines.

TCPL stated that the detailed stress analysis would be completed prior to the final design of the pipeline system and that the final stress analysis would be submitted to the Board. TCPL testified that the safety margins or the numerical differences between the collapse stresses/strains and theoretical stresses/strains achieved in the original system design would be maintained in the present system.

TCPL explained its approach to fracture control design and submitted the results of calculations of the critical crack lengths for fracture initiation and required fracture toughness for self-arrest. TCPL would specify a 60 percent minimum shear area and an all heat average of 85 percent on the drop weight tear specimen at the design temperature in order to prevent brittle fracture propagation. TCPL would also specify an average Charpy absorbed energy to reduce the ductile fracture propagation length. For small diameter pipes, the average value was not specified because the value of the minimum absorbed energy specified for fracture initiation control is greater than the required value for fracture propagation control. TCPL presented its criteria for ductile fracture propagation control, which, when applied to buried pipelines from 610 mm to 1219 mm, would produce a probability of two percent for a fracture propagating more than six pipe lengths.

TCPL stated that it was in the process of revising its materials specifications, F3, P04, and P02 to reflect technical and metric changes. The revised specifications would be applicable to the proposed pipeline. TCPL would use the 1979 edition of CSA Standards Z184 and Z245.1 to .5 for material selection.

TCPL confirmed that all girth welds on the mainline and laterals would be 100 percent radiographically filmed. TCPL undertook not to place any section of its proposed pipeline in operation until all welds had been inspected and found satisfactory in terms of the CSA Z184-M1979 workmanship criteria.

For preliminary design and cost estimating purposes, TCPL assumed that the pipe would be coated with extruded polyethylene or tape. Final coating specifications would be contained in the final design.

#### 6.1.2.4 Construction

The pipeline would be constructed mainly in summer with drilling and rock blasting being performed in winter when necessary.

With the exception of certain compressor stations, the construction of the pipeline facilities will take place in five phases commencing in 1980 and finishing in 1984.

Table 6-6 illustrates TCPL's proposed construction schedule and the number of spreads necessary to complete each phase.

The construction of the pipeline will take place in certain areas where there is Champlain Sea clay or marine clay. In such an area, there is a tendency for the strength of the soil to diminish with increasing water content. During rainfall, trench wall instability could occur and it would be difficult to move equipment and materials under such conditions. TCPL stated that if the rainfall was heavy and prolonged, there might be a need to suspend work until the surface material was capable of bearing the weight of construction equipment. The decision to stop construction in these areas in the event of wet weather would normally be handled by consultation between the geotechnical and environmental specialists in conjunction with the construction supervisor. TCPL had made allowance in its construction schedule for poor weather shutdowns.



Table 6-6TCPLCONSTRUCTION LOGISTICS AND SCHEDULE

	<u>Location</u>	<u>Year</u>	<u>Number of Spreads</u>
Phase I	St-Lazare to Trois-Rivières	1980	4
Phase II	Trois-Rivières to Lévis/Lauzon	1981	6
Phase III	Thurso Lateral and Eastern Townships	1982	4
Phase IV	Lac St-Jean (Quebec to Alma) Eastern Townships, Beauce Lateral	1983	4
Phase V	Lac St-Jean (Alma to Dolbeau) St-Lazare to St-Mathieu	1984	2

6.1.2.5 Operations, Maintenance and Communications

TCPL proposed to establish an Area Office in Quebec City (to be shared with Q & M) and three pipeline District Offices spaced along the pipeline.

The pipeline would be patrolled once a week by aircraft.

At river crossings, underwater inspection would be carried out periodically to check for pipeline exposure or river bottom scour.

Although all compressor stations would be designed for unattended remote operation with control exercised by the Control Office, they would be attended at all times to ensure safety, reliability and continuity of operation.

TCPL stated that the staff would receive adequate training for the operation and maintenance of the facilities, and that emergency procedures manuals would be prepared.

6.1.2.6 Electrical Interference Problems

TransCanada's route in Quebec has been selected to make extensive use of adjacent electric transmission facilities. In particular Hydro-Quebec transmission lines will be paralleled through

the Crabtree/Joliette area, from Berthierville to Maskinongé and from St. Grégoire towards Fortierville. A detailed breakdown of the number of kilometres of parallelism to power lines as well as the number of crossings is provided in evidence.

TransCanada stated that the pipeline would be grounded in accordance with CGA's "Recommended Practice OCC-3-77 for the Mitigation of Alternating Current and Lightning on Metallic Structures and Corrosion Control Systems" in any areas where induced voltages could present a hazard. Further protection to the public would include the use of fences to restrict access and secure bonding of grounds so they cannot be easily removed. During construction, ground mats, gloves and mitts would also be used to protect personnel, if adequate mitigation by grounding alone is not readily obtainable. Studies have already been undertaken where the pipeline crosses rights-of-way between Montreal and Quebec to determine the magnitude of induced voltages. TransCanada also filed a copy of a letter from Hydro-Quebec stipulating their concerns and conditions for any joint use rights-of-way. These concerns covered all aspects of electrical interference as well as the need to coordinate with the affected utility any cathodic protection employed by the Applicant.

#### 6.1.2.7 Views of the Board

With regard to design methodology, geotechnical design, materials engineering, construction, operations, maintenance and communications, and electrical interference the Board has made the following findings.

##### Design Methodology

The Board agrees with TCPL's design for:

- (a) the mainline for the export, non-export, and Quebec-only cases;
- (b) the lateral and sub-lateral lines.

The Board concludes that:

- (a) due to the uncertainty associated with forecasting future market demand, approval should be given only to the mainline compression facilities that are required to meet TCPL's

forecast market demand for the year 1984/85, rather than those required to meet the demand for the year 1989/90 as proposed by TCPL;

- (b) for the export case, the construction of mainline compressor stations at St-Lazare (two gas turbine units), St-Jérôme (two electric units), Louiseville (two electric units), and St-Nicolas (two electric units) would be necessary;
- (c) for the non-export case, the construction of mainline compression stations at St-Lazare (two gas turbine units), and St-Nicolas (two electric units) would be necessary;
- (d) for the Quebec-only case, approval would be given for the construction of the mainline compression facility at St-Lazare (two gas turbine units) would be necessary; and
- (e) compression facilities for the lateral and sublateral systems should not be approved at this time, since these facilities are not required to meet the demand until after the year 1984/85.

The Board notes that additional compression facilities might be required for TCPL's system within a few years following completion of construction of the approved facilities. The Applicant will be in a better position to assess the market potential and the need for additional compressor facilities at a later date.

The Board recognizes that the TCPL system design contemplated the use of underground storage to service the Quebec demand in emergency situations only. The Board is of the opinion that the impact upon TCPL's pipeline extension would be minimal if Q & M's underground storage facilities were not approved.

#### Geotechnical Design

The Board notes that TCPL has taken into account geotechnical considerations in designing and cost estimating its pipeline system.

The Board is satisfied that the nature of the materials to be traversed by the proposed pipeline and their parameters are known from past research and construction experience.

The Applicant has committed to make further site-specific studies and the Board would require, as a condition of a certificate, these site-specific geotechnical studies particularly at sites of unstable slopes as well as a description of any additional construction measures to be submitted during final design.

#### Materials Engineering

The Board finds that TCPL's preliminary fracture control design, materials specifications, and other aspects of materials quality assurance are adequate for the purpose of the application. In order to arrive at the final material design of the pipeline, a final stress analysis, final fracture control design and final specifications for line pipe, components and coatings must be prepared and would be required to be submitted to the Board for approval.

The Board would require TCPL's forthcoming revisions to its materials specifications F3, P04, or P02 to be submitted for review before completion of the final design.

The Board fully supports TCPL's plans for 100 percent radiographic inspection of all girth welds.

The Board is satisfied with TCPL's undertaking that the CSA-Z184-M1979 workmanship criteria would be met in all instances in respect to the standards of acceptability of the girth welds.

#### Construction

The Board is satisfied that proper construction methods would be utilized but would require that construction and trenching be temporarily halted in marine clay areas during periods of low soil stability.

The Board notes that the construction schedule would be realistic, providing there is no shortage of skilled manpower to construct the pipeline.

#### Operations, Maintenance and Communications

The Board is satisfied with the proposed operations, maintenance and communications procedures. A copy of a detailed operations and maintenance manual and an up-to-date emergency procedures manual would be required by the Board prior to the operation of the pipeline facilities.



### Electrical Interference

The Board is satisfied that TCPL would implement all the necessary precautions to mitigate the effects of electrical interference.

#### 6.1.3 Cost of Facilities

##### 6.1.3.1 Transmission Facilities Proposed by TCPL

TCPL estimated the cost of constructing its proposed facilities for the export, non-export and Quebec-only cases.

Mainline pipe size would be smaller for the non-export and Quebec-only cases than for the export case. The compression facilities would be different in all three cases.

For details of pipeline facilities for the three cases, see Tables 6-2 to 6-5.

The export case facilities would be constructed in the period 1980 to 1988, at a 1979 dollar cost of \$383.5 million. For the non-export case, the TCPL facilities would be constructed in the period 1980 to 1987, at a 1979 dollar cost of \$350.8 million. The 1979 dollar cost estimate for the facilities of the Quebec-only case, to be constructed in the period 1980 to 1989, is \$336.1 million.

Table 6-7 shows a breakdown of TCPL's facilities estimates based on first-quarter 1979 dollars, for the above cases.

TCPL's estimate for "metering" costs for the export and non-export cases shown in Table 6-7 includes \$1.4 million of direct cost for two metering stations located at St-Lazare and St-Mathieu for the interconnection with the existing TransCanada system under the joint venture proposal. Other facilities represent the cost of area and district offices facilities, including heavy equipment, plant, aircraft, and communications facilities at those locations. Pre-permit costs include the costs for studies, preparation of the application and expenses incurred during the hearing. The item "NEB monitoring" was arbitrarily selected, in the absence of previous experience, at one percent of the direct cost.

TCPL indicated that two of its compressor stations would be designed for reversible flow, which would cost an additional \$200,000 at each station. However, these facilities would not be required for the Quebec-only case; thus, this cost is not included in Table 6-7.

The labour component of the total cost is approximately 58 percent, the balance representing the cost of materials.

TCPL's escalated cost of the proposed facilities was based on inflation rates of 11.8 percent in 1979 down to 5.3 percent in 1990. On this basis, the escalated total cost of the export case, was estimated to be \$474 million, the non-export case, \$434 million, and the Quebec-only case \$410 million. These three figures do not include allowances for funds used during construction.

Table 6-7

TCPL

TOTAL COST OF QUEBEC FACILITIES

(\$ 1979 millions)

<u>Direct Costs</u>	<u>Export</u>	<u>Non-Export</u>	<u>Quebec-Only</u>
Pipeline	\$260.055	\$243.653	\$239.616
Compression	47.589	33.301	24.680
Metering	8.961	8.961	8.961
Other Facilities	<u>10.606</u>	<u>10.452</u>	<u>10.452</u>
Sub-Total Direct Cost	\$327.211	\$296.367	\$283.709
 <u>Indirect Costs</u>			
Engineering	\$16.360	\$14.820	\$14.185
Contingency	16.360	14.820	14.185
Pre permit	7.075	7.075	7.075
NEB Monitoring	3.109	2.796	2.695
Management & Overhead	12.311	14.019	13.420
O & M Prior to Service	<u>1.034</u>	<u>.929</u>	<u>0.889</u>
Sub-Total			
Indirect Costs	<u>\$ 56.249</u>	<u>\$ 54.459</u>	<u>\$ 52.449</u>
TOTAL	<u>\$383.450</u>	<u>\$350.826</u>	<u>\$336.158</u>

6.1.3.2 Cost of Quebec Distribution Facilities

TCPL commissioned a study of the cost of distribution facilities in Quebec. This study included unit capital costs of distribution for the residential, commercial and small industrial market sectors based on a study of the municipalities of St-Jean/Iberville,

considered to be a typical medium-sized industrial centre in Quebec. The costs of distribution systems were determined for the large industrial loads in sixteen North Shore and Eastern Townships communities.

TCPL applied the unit costs of distribution developed for St-Jean/Iberville throughout the Province, and the costs developed for North Shore and Eastern Townships communities to the industrial load of other load centres having similar characteristics.

The total cost of distribution in Quebec extension and existing franchise area expansion markets for the years 1981 to 1990 amounted to \$580 million, in 1979 dollars. A capital cost summary is shown in Table 6-8.

TransCanada used typical conversion costs for the large commercial and small industrial market sectors. The costs of conversion for the medium and large industrial market sectors were estimated using the results of a field survey. TransCanada assumed that the residential and small commercial customers would not have their conversion costs paid, but indicated that it endorsed conversion costs of the latter sectors estimated by its consultant.

The total capital cost of conversion in Quebec extension and franchise area expansion markets amounted to \$53.3 million in 1979 dollars under TransCanada's assumptions.

In its intervention, Gaz Métropolitain submitted estimates of the cost of distribution facilities in Quebec. These costs, covering a total of 23 load centres plus the expansion of its current franchise area, amounted to a total of \$802 million (1979 dollars) by 1990. These included distribution costs, conversion costs in each market sector for five years after penetration, and general and administrative capital costs all determined after visits to each community. Typical unit conversion costs utilized by Gaz Métropolitain are shown and compared with TCPL unit conversion costs in Table 6-9.

Gaz Inter-Cité, in its intervention, also submitted capital cost estimates of distribution in Quebec outside of the existing franchise area of Gaz Métropolitain amounting to \$485 million, (1979 dollars) by 1990.

Table 6-8TCPLESTIMATED CONVERSION AND DISTRIBUTION COSTS IN QUEBEC

(\$1979 thousands)

	(1)	(2)
<u>Year</u>	<u>Conversion Cost</u>	<u>Distribution Cost</u>
1981	1,678	19,886
1982	3,553	28,101
1983	3,420	35,265
1984	12,194	72,406
1985	5,517	53,781
1986	6,425	79,420
1987	2,850	67,019
1988	6,346	69,578
1989	6,183	89,135
1990	5,135	65,887
TOTAL	53,301	580,478

(1) From Table 6, Section 8-Q-C-3 (JA)

(2) From Table 9, Section 8-Q-D-3 (JA)

Table 6-9TCPLCOMPARISON OF ESTIMATED COSTS OF CONVERSION - QUEBEC(\$1979 per 10<sup>3</sup>m<sup>3</sup> unless otherwise specified)

	(1)	(2)
<u>Sector</u>	<u>TCPL</u>	<u>Gaz Métro</u>
Residential	258.74	\$1000 per dwelling unit
Commercial		
Small	72.14	61.78
Medium	44.95	61.78
Large	12.09	17.65
Industrial		
Small	47.22	42.36
Medium	46.83	42.36
Large	6.42-17.38	17.65

(1) From Section 8-Q-D-4, pp. 7 and 10

(2) From Transcript Vol. XLIV, pp. 6956 to 6958.



#### 6.1.3.3 Views of the Board

With regard to the cost of transmission facilities, the Board is of the opinion that:

- (a) subject to final design changes resulting from site-specific terrain analysis, TCPL's cost estimates shown in Table 6-7 are reasonable;
- (b) the escalation rates used by TCPL are somewhat conservative in light of recent economic forecasts and the expected growth of pipeline construction during the coming decade;
- (c) the TCPL forecasted escalation cost of the project could be increased by \$90 to \$125 million because of the low escalation rates used by TCPL;
- (d) the estimates of direct cost should be reduced by \$9.6 million (as shown in Table 6-7, TCPL included \$9.6 million in direct costs for the St-Lazare/St-Mathieu pipeline loop, which is considered in part of TCPL's upstream facilities and is covered in a later section of this report); in addition, the estimates in Table 6-7 should be reduced by \$1.5 million for the Quebec-only case (as there is no need for the St-Lazare and St-Mathieu receipt metering stations for the transfer of gas ownership as long as TransCanada remains the holder of the certificate to construct and operate the facilities).
- (e) TCPL's proposed facilities should be approved only to the end of the 1984 construction schedule;
- (f) with the exclusion of the costs incurred beyond 1984, as well as the exclusion of the two metering stations, and of the cost of the segment between St-Lazare and St-Mathieu and between Marelán and Thurso, the cost of the project in 1979 dollars would be \$345 million for the export case, \$313 million for the non-export case, and \$297 million for the Quebec-only case (excluding St-Mathieu and St-Lazare meter stations).

With regard to the cost of distribution facilities, the Board notes that:

- (a) regional factors were not taken into account by TransCanada in the determination of the distribution costs, except in the large industrial market sector;
- (b) estimates of cost outside the current Gaz Métropolitain franchise area submitted by two potential distributors substantiates the cost supplied by TCPL.

The Board finds that the TCPL estimated costs of distribution for the Province of Quebec as a whole provide a reasonable estimate of costs associated with the Applicant's demand forecasts.

With regard to the estimated costs of conversion, the Board agrees with the typical conversion cost approach for the large commercial and small industrial market sectors, and similarly agrees with the individual approach for the medium and large industrial market sectors.

#### 6.1.4 Upstream Facilities

##### 6.1.4.1 Evidence of the Applicant

TCPL provided ten studies representing the incremental cost of upstream facilities between Empress and St-Lazare in operating years 1980-81 through 1989-90 for various market scenarios.

Because of time constraints, TCPL did not study a case including its current and projected Canadian gas markets along its existing pipeline upstream as well as the exports authorized by existing licences and by new licences granted under the Licence Phase report.

TCPL suggested that a good approximation of the incremental cost of upstream facilities could be obtained from four cases submitted during the hearing. One of these cases, designated as Case D, and representing the base case, included the current and projected Canadian gas markets along the existing TCPL facilities, export markets permitted by existing licences and the extension of Licence GL-1 until 1985-86 and transportation of Consolidated Natural Gas in 1980-81. The other three cases, designated as Cases E, J and K included Case D volumes, additional volumes for the expansion market in Quebec (Case E), Quebec and Maritimes (Case J), and Quebec and Maritimes with exports at St. Stephen (Case K).

According to TCPL, the difference between any of the expansion Cases E, J or K and base Case D would provide the relative TCPL upstream incremental cost for the particular expansion market.

The upstream capital and operations and maintenance costs discounted at 10 percent to 1980 are presented in Table 6-10.

TransCanada stated that the North Bay shortcut as presented in its upstream incremental facilities would be economically viable for a Quebec-only expansion or a Quebec and Maritimes expansion. A Montreal market expansion only would not be sufficient to economically justify the North Bay shortcut. A daily throughput of  $38 \times 10^6 \text{ m}^3$  per day east of Toronto in 1989-90 would be needed for the North Bay shortcut to break even in a twenty-eight year study period. A volume of  $27 \times 10^6 \text{ m}^3$  per day would have to move through the North Bay shortcut in order to serve the existing and expansion markets downstream of Toronto, representing approximately half the volume required.

The construction of the North Bay shortcut was scheduled for 1981 and 1982, but a definite routing had not yet been selected.

Other alternatives were studied such as a Ramore shortcut but the North Bay shortcut was found by TCPL to be the most economical and appropriate.

In its application, TCPL had included the looping of its section of pipe between St-Lazare and St-Mathieu to meet the Eastern Townships 1984-85 volume forecast. The 1979 estimated direct cost is \$9.6 million. This looping is upstream of the St-Mathieu meter station proposed in the application. TCPL stated that the investment generated would be assigned to TransCanada's existing facilities.

#### 6.1.4.2 Views of the Board

The Board recognizes that the incremental costs of the upstream facilities submitted by TCPL provide only an order of magnitude as they are based on throughput volumes which did not fully reflect the Board's Licence Phase decision. In addition, the Board realizes that the final routing of the North Bay shortcut may affect the cost.

In order to determine the costs of the additional upstream facilities, the Board established the current and forecasted capacity

Table 6-10

<u>TCPL</u> <u>ESTIMATED INCREMENTAL COST OF UPSTREAM FACILITIES</u> <u>1980-1990</u> <u>(Discounted at 10 percent to 1980)</u>						
<u>Quebec-Only</u>			<u>Non-Export</u>		<u>Export</u>	
1980			1980		1980	
(\$millions)			(\$millions)		(\$millions)	
<u>Facilities</u>	<u>Cost</u>		<u>Facilities</u>	<u>Cost</u>	<u>Facilities</u>	<u>Cost</u>
<u>Western</u>						
Pipeline (km)	61	35.653	88	41.648	311	81.130
Compressor stn.	9	35.567	10	41.251	10	52.357
<u>Central</u>						
Pipeline (km)	812	174.304	965	195.817	1443	299.290
Compressor stn.	-1	11.548	-1	15.895	-	27.815
<u>Eastern</u>						
Pipeline (km)	-281	(46.482)	-281	(46.418)	-281	(46.488)
Compressor stn.	-4	(16.104)	-4	(15.219)	-4	(15.221)
<u>North Bay Shortcut</u>						
Pipeline (km)	475	165.018	475	205.170	475	205.170
Compressor stn.	4	11.299	4	20.469	4 <sup>(1)</sup>	18.547
<u>Sub Total</u>						
Pipeline (km)	1067	328.493	1529	396.147	2229	539.102
Compressor stn.	8	42.310	16	62.396	16	83.498
O & M <sup>(2)</sup>		<u>86.305</u>		<u>104.558</u>		<u>171.428</u>
Total						
<u>Discounted Cost</u>		<u>457.108</u>		<u>563.101</u>		<u>794.028</u>

(1) The reduction in the number of compressors for the export versus the non-export case is a result of a change in pipe diameter from 114 mm for the non-export to 1 067 mm for the export.

(2) Operations and maintenance.



requirements of TransCanada's Western, Central and Eastern sections on the basis of the Board's current demand forecast (Appendix C of the Licence Phase report) including the recent export decision.

The TCPL throughput requirements are composed of the Canadian requirements for the existing market areas, transportation and export obligations, including the Licence Phase decision, and the projected Canadian requirements for the expansion markets east of the existing markets.

For the determination of the additional facilities in the Western and Central Sections, the Board's throughput requirements presented in Tables 1 to 8 of Appendix 6 were used. The assumptions for this analysis are outlined on pages 1 and 2 of Appendix 6.

For the Eastern Section, TCPL has indicated, as outlined earlier in this report, that the North Bay shortcut could be economically justified at a daily throughput of  $38 \times 10^6 \text{ m}^3$ . Under the Board's throughput forecast, the North Bay shortcut would be required by 1985. For the 54 km St-Lazare/St. Mathieu loop projected to be constructed in 1984, the Board is of the opinion that it is too early to certificate this loop with the present application, and that it should form part of a future upstream facilities application. Therefore, the St-Lazare/St. Mathieu looping has been included in the Board's study as upstream facilities in the Eastern Section.

For the aforementioned throughput requirements, the Board, utilizing a 10 percent discount rate, estimated the costs (capital and operations and maintenance, including fuel) to 1980, of the upstream facilities for the period 1980 to 2000 to be \$410 million (1979 dollars) for the Quebec case and \$550 million (1979 dollars) for the Quebec and Maritimes case.

#### 6.1.5 Right-of-Way (TransCanada)

##### Introduction

In its route selection process, TransCanada considered various factors which could impose limitations on pipeline location. Relevant federal, provincial, and municipal agencies were consulted to obtain information on land uses which could conflict with the pipeline such as areas of urban development, Indian lands, areas of mining activity, water

supply sources, parks, reserves, and recreational lands. Studies of these areas resulted in the elimination of possible alternative routes and in the final determination of the prime route. Following selection of the prime route, TransCanada initiated the land acquisition procedures set out in its application.

The following sections of the report outline TransCanada's policies and procedures with respect to right-of-way.

#### 6.1.5.1 Land Use

##### Infrastructure

TransCanada stated that the proposed mainline to Quebec City would parallel the rights-of-way of existing utilities wherever possible. The Applicant indicated that particular emphasis was placed on this principle in areas of potential urban growth in order to avoid imposing restrictions on future development. The Applicant indicated that routes in the Eastern Townships were selected to make extensive use of adjacent electric transmission rights-of-way.

##### Areas of Urban Development

TransCanada compiled information on the existing land use and urban development trends for the communities along the proposed mainline and the Eastern Townships laterals. Evaluation of this information resulted in a route that would avoid urban areas to a large extent and that would minimize disruption where it did have to pass through developed areas.

TransCanada was questioned during the hearings about its choice of routes through Quebec City and Shawinigan. TransCanada testified that the proposed pipeline route would follow a utility corridor for most of the distance through the built-up areas of Quebec City and Shawinigan, and that the reason for routing through urban areas was to get as close to the market take-off point as possible. TransCanada agreed that urbanized areas should be avoided to the extent that this priority could be consistent with serving designated markets. TransCanada did not consider alternative routes around Quebec City as it was satisfied with the use of utility corridors through the area.

### Indian Lands

TransCanada testified that the proposed route would not cross any Indian Reserves in the Province of Quebec. The Applicant stated, however, that it was difficult to determine what lands might be subject to Indian claims.

### Mining

TransCanada testified that it had not made a search of mining leases or mining properties, but that studies of this nature would be completed several months prior to construction.

TransCanada gave evidence that the pipeline would avoid being in proximity to any operating mines but could not confirm that the proposed pipeline would avoid areas under certain types of mining lease.

TransCanada identified and evaluated sixteen sand, gravel and quarry permits along or within some 300 m of the proposed route between St-Lazare and Quebec City. The various operations evaluated could be classified as either sand pits or rock quarries and were identified as active or inactive.

The Applicant stated that with the exception of the extensive holdings of Québec Ready Mix, in the Quebec City area, the proposed pipeline would have no effect on any rock quarry operations. TransCanada's consultant indicated that additional subsurface geological information would be required for this area and that a minor realignment could be necessary.

TransCanada noted that it was difficult to define, with a reasonable degree of certainty, the future plans and operating schedules for these operations as owners were reluctant to divulge this information.

The Applicant testified that there could be locations along the proposed route where existing borrow pits were not available. TransCanada stated that where existing borrow pits could not be utilized, its contractor would obtain permission from the Province of Quebec to open new borrow pits under the restrictions set out by the Province.

TransCanada testified that in locations where existing pits would be utilized it was not its intention to determine whether the use



of the pits would cause shortages to other users of such pits. The Applicant gave evidence, however, that it would abide by permit restrictions on volumes for borrow material.

#### 6.1.5.2 Notifications of Affected Authorities & Requisite Approvals General

TransCanada stated that following the granting of a certificate, negotiations would commence with all federal, provincial and municipal agencies having jurisdiction over public lands and public utilities to obtain all permits necessary for crossings or parallel encroachments.

#### Federal Authorizations & Legislation

The Applicant gave evidence that the Ministry of Transport had been approached to obtain requisite approvals pursuant to section 76 of the NEB Act for the crossing of navigable waters. The Ministry of Transport had classified all rivers which would be crossed during construction proposed for 1980 as to their navigability, and had given approval in principle for the three major river crossings between St-Lazare and Quebec City. The Ministry of Transport had been given copies of the route sheets for Quebec but had not at the time of the hearing completed its assessment of design features such as crossings which could affect these rivers. TransCanada agreed to file a list of the navigable waters along the route.

TransCanada had not contacted the Canadian Transport Commission regarding the proposed railway crossings under the Commission's jurisdiction, as the site-specific crossings of the pipeline with the railway had not been determined at the time of the hearing.

TransCanada testified that it would obtain the approval of the railway companies and file these documents with the Transport Commission to obtain approval under the General Order No. 1977-3 Rail.

The Applicant indicated that the proposed route would cross the edge of the Trois-Rivières airport property. TransCanada testified that this location had been selected in order to avoid a highway, buildings located along the highway and an industrial development. The Applicant gave evidence that the necessary authorities would be contacted to obtain authorization to locate within the airport property.



The Applicant stated that the historic Chambly Canal would be crossed by the proposed St-Mathieu to Sherbrooke lateral. It testified that Parks Canada has indicated that it would have no objection to the construction taking place during the winter months.

#### Provincial Authorizations and By-Laws

TransCanada testified that it had identified all the various provincial authorities from whom requisite approvals would be required and had confirmed that necessary arrangements had been or would be made to avoid any potential conflicts.

The Applicant indicated that it would utilize approximately 4 km of a Hydro-Québec right-of-way along the proposed route from St-Lazare to Quebec City. The proposed mainline to Quebec City would encounter 32 crossings of Hydro-Québec rights-of-way containing power lines of 69 kV or greater.

TransCanada filed a copy of an agreement between itself and Hydro-Québec setting out terms and conditions for the proposed pipeline construction across, along and within, and adjacent to Hydro-Québec rights-of-way. Hydro-Québec would have no objection to the use of its power transmission line rights-of-way by TransCanada subject to the terms and conditions set by Hydro-Québec.

The Applicant stated that information with regard to the proposed pipeline system in the Eastern Townships as it would affect Hydro-Québec rights-of-way would be submitted at a later date.

The Applicant testified that it had conducted information meetings with agricultural authorities and that guidelines would be forthcoming.

TransCanada gave evidence that an application had been made to the Commission de Protection du Territoire Agricole du Québec for approval of the proposed pipeline through agricultural lands as now required under Bill 90 (an Act to Preserve Agricultural Land).

#### Municipal Authorizations & Legislation

TransCanada stated that certain procedures would be followed to ensure that each municipal office would receive a route map showing the location of the proposed pipeline through the municipality as well as

typical drawings showing the proposed method of crossing roads and drains under municipal jurisdiction. In support of the 'Leave-to-Construct' application, pursuant to section 76 of the National Energy Board Act, the Applicant would request the municipalities to return signed prints of route maps and detailed crossing drawings of all highways and facilities under their jurisdiction. These signed prints would indicate to the Board the municipalities' approval of the crossings as shown on the detailed drawings.

TransCanada indicated that should a routing change become necessary, revised route maps and crossing drawings would be forwarded to each party involved and a revised application for 'Leave-to-Construct' would be made to the Board. The Applicant would request from the municipalities signed prints of revised route maps and detailed crossing drawings in support of the revised application.

TransCanada stated that its right-of-way agents had visited the offices of the municipalities and discussed the proposed pipeline route in relation to present and future planning and development and testified that it would follow the procedures for notification of municipal authorities set out in its application.

The Applicant stated that the municipal authorities would be notified as to the month during which construction would likely commence at the time of transmittal of the route maps and crossing drawings. The Applicant further indicated that designated representatives in each municipality would be notified at least 48 hours prior to the commencement of pipeline construction.

#### 6.1.5.3 Land Requirements

##### Permanent Rights-of-Way

TransCanada stated that it would secure for the mainline a 22.86 m wide right-of-way by means of servitude, and that the right-of-way would generally be restricted to 19.81 m where the mainline crossed wooded areas. For the laterals, TransCanada indicated that they would generally be constructed in rights-of-way of 12.19 m.

TransCanada testified that it was aware that it would be necessary to make application to the Board, pursuant to section 74 of the Act, in the case where a right-of-way width would exceed 18.29 m and the consent of the owner could not be obtained for such lands.

The Applicant stated that additional servitudes would be required for the installation of cathodic protection facilities during the operation phase.

#### Temporary Rights-of-Way

TransCanada testified that temporary rights-of-way would be required for pipe stockpiling, vehicle and equipment storage, fabrication yards, and work and fabrication areas associated with river, road and rail crossings. TransCanada further testified that on the 22.86 metre-wide mainline right-of-way, there would be spot locations where temporary rights-of-way would be required because of construction techniques employed in the drainage bedding systems in the Province of Quebec. On the 12.19 metre-wide right-of-way on laterals, the Applicant would require temporary rights-of-way when topsoil stripping is required.

TransCanada stated that it would require temporary working rights for a pull area 200 m by 200 m on the north side of the Oka crossing and for a staging area 200 m by 800 m on the southwest side. TransCanada testified that discussions with the landowners involved were taking place, but that they had not reached agreement. TransCanada further stated that the exact locations of these areas had not been decided, but that they were aware that some trees would have to be cleared in a 50 m by 50 m section of the pull area on the north side of the crossing. This area was described as being "sparsely wooded". TransCanada further testified that arrangements had not yet been made concerning the crossing of Highway 344, on the north shore, during the pulling operation. It was aware that the traffic would be disrupted periodically during the two-week operation, but indicated that the interruption would not be serious.

#### Joint Rights-of-Way

TransCanada stated that the proposed route made extensive use of the corridor concept and that the pipeline would parallel the rights-of-way of existing utilities wherever possible.



Utilities paralleled by the pipeline would be as follows:

- (a) the IPL oil pipeline from St-Augustin to Ste-Anne des Plaines;
- (b) the Hydro-Québec transmission line through the Crabtree/Joliette area, from Berthierville to Maskinonge and from St-Gregoire towards Fortierville;
- (c) an abandoned railway line from Bécancour to Fortierville; and
- (d) segments along other highways, railways and utilities.

The Applicant testified that it would not share any existing rights-of-way except approximately 4 km of right-of-way owned by Hydro-Québec along the proposed mainline from St-Lazare to Quebec City. TransCanada stated that information on joint right-of-way use in the proposed Eastern Townships lateral would be submitted at a later date.

#### Fee Lands

TransCanada stated that it would require the construction of 7 compressor stations in the Province of Quebec for either its export or non-export case.

TransCanada stated that approximately 8.09 ha of land would be required for the St-Lazare compressor station site, while each of the remaining compressor station sites would require approximately 4.05 ha of land.

The Applicant indicated that land requirements for each meter station site would not exceed .24 ha. Final station locations would be determined by criteria such as accessibility and availability of electric power, suitable terrain and minimal impact on agricultural land. Buildings would be designed and sites landscaped to blend the facility with the surrounding environment.

TransCanada stated that it would purchase land in fee simple for the construction of sales meter stations, compressor stations, district offices and maintenance bases.

#### 6.1.5.4 Land Acquisition

##### Landowner Notifications & Documentations

The Applicant stated that its representatives had contacted some of the landowners along the proposed route and had provided



information on its project, general information concerning pipeline construction and operation as it would affect their property, and information on servitudes required for pipeline purposes.

TransCanada testified that prior to the hearing approximately 98 percent of the landowners between St-Lazare and Quebec City had been contacted, but that landowners had not yet been contacted in other areas.

The Applicant stated that prior to negotiating a servitude, or acquiring any property, it would provide each landowner with a map and a description locating the right-of-way, an offer of compensation for the lands affected and a copy of the standard agreement between the parties.

TransCanada stated that it would give advance notice of construction scheduling to all landowners, tenants and occupants along the pipeline route, and would provide right-of-way personnel to assist landowners and to make any special arrangements for such requirements as access, temporary work permits, fencing and drains.

#### Plans, Profiles and Books of Reference

The Applicant indicated that, following the granting of a certificate, the plans, profiles and books of reference would be completed and submitted to the Board for approval.

TransCanada expected to reach agreement with the majority of landowners prior to submitting its plans, profiles and books of reference. It gave evidence that, if required by the Board, it would notify each of the landowners, in writing, of the fact that TransCanada had applied for approval of plans, profiles and books of reference.

The Applicant would execute and register all servitudes and acquisitions on completion of legal surveys across each property affected.

#### Easement Documents

TransCanada gave evidence that a large number of landowners and farm organizations had requested a single line easement, and that single line easements would be negotiated for these properties.

The Applicant filed with the Board a standard copy of its "Option for Servitude and Right-of-Way" document as well as the "Deed of

Servitude and Right-of-Way" document which would be utilized during right-of-way acquisition.

#### Expropriations

TransCanada stated that it would make every effort to avoid expropriations and that previous experience in acquiring rights-of-way indicated that less than one percent of the properties would require expropriation procedures.

TransCanada gave evidence that, should expropriations be necessary, the construction schedule was flexible enough to incorporate expropriation procedures without delaying construction.

#### Further Hearings

TransCanada testified that it had taken into account the possibility of further hearings with respect to various landowner concerns. TransCanada gave evidence that particular consideration was provided in the 1980 construction schedule to accommodate such hearings, and that the proposed construction schedule could accommodate any realignments of the proposed pipeline required as a result of further local hearings.

#### Line Lists

TransCanada testified that it would complete a pre-construction report containing landowner concerns which would be signed by the owner and by the right-of-way agent upon completion of right-of-way negotiations. A copy of this report would be left with each landowner.

The Applicant testified that the pre-construction report would be used to compile the line lists for the project. TransCanada gave evidence that these line lists would be utilized by the contractor and all inspection personnel during construction. It agreed to file copies of the line lists with the Board.

#### 6.1.5.5 Post-Construction Activities

##### Clean Up and Compensation

TransCanada stated that upon completion of construction, landowners would be invited to inspect their property to assess the clean-up and restoration of all fences, ditches and drainage systems, as well as any other individual concerns. TransCanada indicated that it

would compensate landowners for any damage to buildings, crops, fences, tile drains, timber culverts, bridges and livestock caused by pipeline construction.

TransCanada confirmed in the hearings that the lands through which the pipeline was to be constructed would be left in such a condition as to not interfere with agricultural or any other purposes for which they might be used.

#### Progress Reports on Clean-Up and Damage Settlements

TransCanada undertook to file with the Board progress reports, if required, on the clean-up efforts which had been completed and on the damage settlements reached, as well as details relating to those properties where settlements could not be reached along with reasons for the inability to reach a settlement.

#### Landowner Liaison (Operation Phase)

TransCanada stated that it would maintain contact with all owners and tenants along its system and that personnel would be available to discuss any problems relating to the pipeline and use of the right-of-way. The Applicant indicated that any work required along the right-of-way would be discussed with the landowners and that damaged and disturbed areas would be restored and fair compensation paid.

#### 6.1.5.6 Views of Intervenor

UPA intervened on behalf of all farmers who would be affected by the proposed pipeline in the Province of Québec. The Union's primary concern was to ensure that the pipeline would be routed so as to cause the least possible damage to agricultural lands. The Union did not recommend any specific routing changes during the hearing, although it clearly stated that it would favour the location of the pipeline in existing transportation corridors, particularly autoroute rights-of-ways. Upon completion of these studies the farmers might wish to recommend realignments. UPA indicated that the farmers' interests would be best served if the Applicant met with the Union's regional groups along the route, and recommended that the Board require TransCanada to undertake these consultations. The Union stated that



Hydro-Québec has found this method of contact with the landowners to be the most efficient.

Concern was also expressed in the intervention with regard to certain construction procedures. However, UPA stated during the hearing that it was aware of the Applicant's undertaking to use environmentally sound construction methods. The Union intended to emphasize its concern that TransCanada fulfill its commitments, in view of the fact that there have been conflicts between farm operations and pipeline construction in other provinces in the past. The Union recommended that no work should be performed when the ground is saturated. The Union had also made specific recommendations with regard to the Applicant's damage claim settlement procedure, but testified during the hearing that it was aware that the Board did not get involved in these negotiations.

#### 6.1.5.7 Views of the Board

TransCanada has been under the Board's jurisdiction for over two decades, and has shown in the past its appreciation and understanding of requirements in regard to right-of-way matters.

The Board accepts TransCanada's statements that the majority of the proposed route would avoid urban areas and that, where urban areas are unavoidable, mitigative measures would be taken to minimize disruption.

The Applicant has satisfied the Board that the proposed route would not cross any Indian Reserves.

The Board notes the Applicant's statement that it is unaware of any active mining areas along its proposed route. Nevertheless, the right-of-way may be affected by mining activities or mining claims. In the event a certificate were issued, the Board would require, under section 35 of the Act, that TransCanada indicate on the plans, profiles and books of reference filed pursuant to section 29, the existence of any mines or mining claims along the proposed route of the pipeline.

The Board notes the detailed information provided by the Applicant regarding requirements for and locations of borrow resources along the mainline. The Board would require, again, under section 35 of



the Act, in the event a certificate were issued, that TransCanada indicate on the plans, profiles and books of reference filed pursuant to section 29, the existence of any borrow pits along the proposed route of the pipeline.

TransCanada has satisfied the Board that necessary arrangements have been or would be made with all federal, provincial and municipal government authorities regarding its proposed pipeline.

The planned rights-of-way widths, submitted by TransCanada, are acceptable to the Board.

The Applicant has satisfied the Board that necessary occupancy arrangements have been or would be made with Hydro-Québec. The Board notes that information on joint use of rights-of-way has been submitted for the mainline and the Board accepts TransCanada's undertaking to file similar information on the Eastern Townships lateral.

The Board accepts TransCanada's position that it can obtain all lands required for compressor and meter station sites.

The Board is satisfied with the procedure established by TransCanada for landowner notifications and land acquisition, and with the manner in which these procedures have been executed to date.

The Board accepts TransCanada's proposal to negotiate a single line right for its pipeline.

The Board notes that TransCanada expects expropriation procedures would be required on less than one percent of the properties affected; however, TransCanada's experience in this matter in the Province of Quebec is limited. The Board would require the Applicant, as a condition of any certificate, to file with the Board concurrent with the filing of plans, profiles and books of reference a listing of all properties subject to expropriation procedures.

The Board accepts TransCanada's undertaking to file line lists with the Board.

The Board accepts TransCanada's undertakings to clean up and restore the lands through which the pipeline would be constructed and to file reports on clean-up progress and the status of damage settlements.

The Board recognizes the possible need to conduct further local hearings and has stated in Procedural Order No. PO-1-GH-4-79 dated 7 May 1979, paragraph 6, that such hearings would deal with specific landowner concerns and would be held prior to the approval of the plans, profiles and books of reference if so required.

#### 6.1.6 Environmental Impact

##### 6.1.6.1 Environmental Considerations in Selecting the Route

Between St-Lazare and Trois-Rivières, ten other routes were investigated. TransCanada concluded that the environmental impact of its proposed route would be significantly less than any of the alternatives since it would cross less forested land than many of the alternatives and would avoid the Paul Sauvé Provincial Park and the Lanoraie Bogs.

As mentioned previously, the major route alternative between Trois-Rivières and Quebec City was a route following the North Shore rather than the South Shore of the St. Lawrence River. The Applicant stated that the North Shore route was rejected in order to avoid difficult river crossings, some major areas of slides and mudflows, extensive bedrock and sensitive spawning areas.

In the Eastern Townships, two main alternatives were rejected since less prime farmland and organic terrain would be crossed on the proposed route. TransCanada also stated that the alternative routes through the Eastern Townships would have had greater potential impact on residential, recreational and industrial land.

TransCanada testified that the final selection of its proposed route to Lac St-Jean would not be finalized until discussions with government biologists have been completed. The Company also testified that the provincial government was in the process of making recommendations regarding the use of existing rights-of-way along this route.

The selection of the route was designed to maximize the lengths of line adjacent to existing rights-of-way and to minimize the impact on forest land, aquatic habitats, ecologically sensitive or unique areas, agricultural lands and special land use areas. Where feasible, the route

avoided topographic obstacles, major urban areas and aesthetically attractive landscapes as well as orchards, sugar bush, important wildlife habitat, major recreational areas and potential archaeological sites. TransCanada's proposed route would avoid all ecological reserves and all provincial or federal parks. In the Montreal region, where recreation lands are at a premium, a number of recreation or conservation zones are planned. The Company stated that provincial authorities would be consulted regarding any proposed parks along the route.

TransCanada informed the Board that provincial government agencies had been consulted during route selection and that their advice was incorporated into the selection process. The Company stated that deviations to the route would continue to be made as additional environmental and engineering data were gathered.

TransCanada initially selected its compressor station sites on the basis of pipeline hydraulic studies. However, final site selection would be based on the accessibility to roads and electric power and on environmental concerns, such as minimizing the impact on agricultural land.

#### 6.1.6.2 Environmental Impact and Mitigative Measures

##### Applicant's Policy

TransCanada stated that its general policy on the construction and operation of its proposed pipeline was to minimize as much as possible disturbance to the environment and to ensure that the condition of all property, including drainage systems, fences, buildings, water channels, forest and agricultural lands, was restored to at least that which existed before construction commenced.

In support of its application, TransCanada submitted an environmental impact assessment of its proposed route. This assessment, prepared by a consultant, consisted of a description of the environment with recommendations for specific mitigative measures to be implemented along the pipeline route. In addition, the consultant acknowledged that in certain instances, site-specific mitigative measures could not be finalized due to insufficient information and recommended that further



environmental studies be undertaken. In conjunction with the environmental impact assessment, the Applicant also submitted its Construction Specifications and its Environmental Protection Practices Handbook, 1979 which detailed more general mitigative measures applicable to most pipeline construction projects.

TransCanada stated that it accepted the recommendations in the environmental assessment and that should any incompatibility arise during construction, further environmental impact studies would be carried out and appropriate mitigative measures would be identified and put into effect.

#### Terrain

TransCanada testified that in general, its policy was to minimize terrain damage. The initial clearing and grading of the right-of-way would be done with a view to causing minimal inconvenience to landowners and minimal injury and damage to the surrounding resources. Unnecessary disturbance of the ground, of the established natural drainage, and of the natural vegetation cover would be avoided.

On completion of the backfill operation, TransCanada would clear the right-of-way of all debris and would fill in all depressions. All disturbed areas would be left in a stabilized condition by means of revegetation or by the placement of binders, rock or gravel blankets or structures. TransCanada also stated that where earth cuts had been made to facilitate the movement of equipment, these areas would be restored to their original profile and condition. Work areas would be chisel-ploughed, graded and prepared for seeding.

Notwithstanding these mitigative procedures, TransCanada acknowledged that serious terrain damage could occur on areas underlain with marine clay, at river embankments and in wetlands.

Potentially unstable Champlain Sea clay deposits, locally known as Leda Clay, underlie large parts of the Central St. Lawrence Lowlands and the Lac St-Jean region. The most critical time of instability in these clays is during periods of excessive moisture when the clays become



saturated with water. On flat ground, construction during wet periods can result in extensive rutting of topsoil and later as the ground dries out, can result in extensive compaction in the subsoil with the passage of heavy equipment. Where the clays occur at deeply incised river and stream channels, they are susceptible to sliding or flowing when water-saturated or when subjected to pressure or shocks.

TransCanada's main mitigative measure would be to avoid construction on clays, either flatlands or steep slopes, during the periods of wet weather. Construction through sensitive clays during the spring thaw or when rivers were in flood would not occur. TransCanada also stated that potentially unstable areas would be avoided when it was necessary to route the pipeline across clay slopes.

TransCanada had established procedures for curtailing construction should a period of heavy precipitation be encountered when constructing on sensitive clays. The environmental inspector in the field might recommend a temporary cessation of work on sensitive sites. Where weather and soil conditions deteriorated, the environmental inspector would forewarn TransCanada's construction supervisor and management personnel and, if necessary, a joint decision would be made on the timing and duration of a shutdown.

The normal precautions which TransCanada would implement to ensure that major slumps did not occur included: diverting water from the trench line, using weeping drains to prevent build-up of water in sloping ground, using pads for heavy equipment to minimize localized heavy pressure and vibration, constructing berms at the top of steep slopes to divert surface drainage away from the disturbed ground, and applying mulches to slopes to provide immediate protection from surface erosion. TransCanada's environmental consultants recommended that detailed geotechnical investigations be completed at the sites of all unstable slopes.

With respect to wetlands, the environmental report stated that much of the surface of the St. Lawrence lowlands is poorly drained.

Consequently, extensive peat bogs have formed which are biologically important as specialized wildlife habitat and, in particular, as waterfowl habitat.

The wetlands are characterized by their high water tables, low bearing strength and low bulk density. To minimize damage, TransCanada's environmental consultants recommended that these regions be crossed between mid-December and mid-March or between mid-June and October 1st. TransCanada testified that it planned to provide for construction through wetlands during the summer, but that changes to its construction schedule would be made if winter construction were required.

#### Archaeological and Historical Resources

Under the Quebec Cultural Property Act, buildings, parts of municipalities, sites of scenic interest and cultural heritage elements can be classified for preservation. The act also provides for a protection perimeter of 173 metres around any classified property. No classified property would be crossed by TransCanada's proposed route and the Company would ensure, during detailed planning of the route alignment, that its line would not be within 173 metres of any protected site.

Prior to construction, TransCanada proposed to conduct a study of the archaeological and historical resources along its route. During construction, the Company would employ a professional archaeologist, on a full-time basis, whose responsibilities would include carrying out a ground survey when the centre line was being established in order to locate any manifestations of an historical or archaeological site. This specialist would be present during the trenching operations in any areas considered sensitive, especially along river and lake banks. If a site were discovered during construction, it was TransCanada's policy to protect the site and to cease construction activities until the site was evaluated by the appropriate authorities. The location of the site would be immediately brought to the attention of the landowner and the Company by the construction contractor. The Company would then advise appropriate provincial authorities.

The contractor's responsibilities towards historical and archaeological resources are contained in TransCanada's construction specifications.

When crossing through farmlands, TransCanada would ensure that all antique fences and farm structures were carefully dismantled and the materials conserved for later reassembly.

#### Agricultural Land Use

With the exception of the Lac St-Jean route, the proposed route of TransCanada would traverse some of the most important agricultural regions in the Province of Quebec. The majority of the agricultural lands are rated in Canada Land Inventory, Soil Productivity Classes 2, 3 or 4.

The main problems associated with pipeline construction through agricultural lands are the preservation of the topsoil and its productivity, compaction of the subsoil, and the restoration of surface and subsurface drainage systems.

To protect the soils in agricultural lands, TransCanada would strip the topsoil layer, except in areas where the topsoil layer is very thin. The width of the topsoil to be stripped would be determined by the environmental inspector, in consultation with the landowner. As a general rule, topsoil would be stripped from the ditch line and from the spoil side of the ditch to a point where the stripped topsoil would be piled. To prevent the mixing of subsoil and topsoil, the subsoil would then be excavated and piled on the exposed subsoil adjacent to, but separate from, the topsoil pile. When the topsoil was being replaced, environmental inspectors would be responsible for determining that the original thickness of topsoil was properly restored and in accordance with any other specific requirements.

TransCanada's environmental consultants recommended that construction on agricultural lands take place between the end of May and the beginning of September when the soils are dry, or from December to March when the soils are frozen to a minimum depth of 13 cm. Such a schedule would minimize compaction and erosion problems.



After the pipe had been buried and general clean-up completed, all work areas would be ploughed to break up the subsoil and to ensure the removal of all debris. Topsoil would then be graded and prepared for seeding using a disc and harrow.

Much of the agricultural land traversed by TransCanada's proposed route contains extensive sub-surface drainage systems. TransCanada stated that its policy was to repair or replace all damaged drainage systems and to maintain drainage patterns. The Company would hire a tile specialist to supervise and inspect tile repairs. TransCanada's methods and procedures to be followed for identifying and repairing or replacing damaged drainage systems are outlined in its Construction Specifications and Environmental Handbook. These documents include instructions on marking cut-tile, maintaining drainage during construction and the timing of tile repairs as well as details on repairing tiles and the minimum depth of cover in drained areas (minimum 1.2 m). TransCanada would ensure that all tile repairs were completely satisfactory to the Company and landowner, and should the Company be made aware of problems resulting from repairs to broken drains, TransCanada would investigate and repair the damage.

When rock-blasting through cultivated areas, matting would be used and all fly-rock escaping off the right-of-way would be immediately collected and disposed of at dumping sites approved by the landowners and the Company.

To protect livestock, TransCanada would construct temporary fences to prevent livestock from entering or leaving the property and would furnish a watchman to maintain these fences and all gates.

#### Forests and Woodlots

The forests crossed by TransCanada's proposed route to Quebec City and in the Eastern Townships are classified by the Canada Land Inventory group into Classes 3, 4 or 5, which have limitations on the growth of commercial forests ranging from moderate to severe. Half of the proposed Lac St-Jean route would be located in forest lands where the volume of merchantable timber per acre is generally greater than the provincial average.



The two primary Quebec forest industries are pulp and paper, and maple syrup products. Sugar bushes are common along the route and are an important economic resource both in terms of their maple products and the associated recreational activities. TransCanada stated that sugar bushes were avoided when possible during route selection; however, the Company indicated in its environmental maps which sugar bush lots would need to be crossed. The Company further stated that certain stands, such as those at Mount St-Hilaire and Mont Orford, have been protected by the Province, either as sanctuaries or parks and were avoided by the TransCanada route.

TransCanada testified that its policy on crossing through forests and woodlots was that all clearing, cutting and removal of trees and bush would be conducted in accordance with good land conservation practices, and that the general mitigative measures stipulated in its Pipeline Construction Specifications would be applied. Prior to construction, TransCanada would mark all specimen trees and would protect them from damage by means of snow-fences or rubber tires. When constructing through forests, TransCanada would limit the right-of-way to a maximum width of 19.8 m. The Company further stated that no graded material would be spread among trees adjacent to the cleared right-of-way.

All non-merchantable debris would be buried, chipped or otherwise disposed of in accordance with landowners' wishes and applicable legislation. All merchantable timber would be cut into 4.9 metre lengths and neatly piled along the right-of-way. If, during clearing or construction, superficial damage occurred to standing trees, it would be repaired with tree surgeon paint.

When crossing particularly valuable woodlots, such as sugar bush, the Company would require hand trenching, if, in its opinion, construction equipment were to cause unnecessary damage or injury to the stands.

A further environmental concern associated with construction through forests and woodlots is the danger of fire. TransCanada proposed

fire-fighting equipment would be on-site. The Company would ensure that the contractors were provided with adequate fire prevention methods, and that all federal, provincial, and municipal fire regulations were followed.

#### Wildlife Resources

The majority of the proposed route to Quebec City lies within the Canada Land Inventory Class 4 for ungulates, with the predominant species being the white-tailed deer. The most critical concern associated with these populations is the protection of their over-wintering areas, known as "yards", particularly, during periods of heavy snow accumulation. The location of most deer yards is known to the provincial government and this information had been provided to TransCanada's environmental consultants.

The route to Lac St-Jean, unlike the remainder of TransCanada's route, would cross lands with relatively high productivity for moose. Some deer are present. The specific habitats of these ungulates were not known and TransCanada's consultants recommended that further studies be undertaken on the location and utilization of moose and deer yards along this route.

While it was TransCanada's policy to avoid deer yards, the environmental maps indicated that the route would cross several. Where crossings were unavoidable, TransCanada would try to avoid the most productive portion of the yard and construct in more sparse or open areas. If necessary, TransCanada would revegetate with trees and shrubs across the right-of-way to provide passage for deer and to impede traffic along the pipeline route. TransCanada's environmental consultants recommended that any crossing of known or potential deer yards should be planned in consultation with wildlife officials. They also recommended that winter construction be avoided and that clearing be kept to a minimum.

With respect to waterfowl, the Canada Land Inventory has designated as Class 6 or 7, almost all of the area through which TransCanada would pass. These classes are characterized as having severe limitations for the production and support of waterfowl. However,

certain locations, occurring mostly in wetland areas, are regionally important for migration stop-overs and as nesting sites. The most significant locations occur in the Eastern Townships (south of Lac Waterloo and at the St-Francis River), along the St. Lawrence River and at the mouths of many of its tributaries, and in the Lake of Two Mountains, Lanoraie Bogs, Lac Saint-Pierre and Lac Saint-Paul areas.

In general, TransCanada's proposed route would avoid major waterfowl areas. Where a crossing could be avoided through route realignment, TransCanada's consultants recommended that construction should not occur from early April to mid-May or from early September to mid-November in order to avoid conflicts with migrating waterfowl. The Company testified that it would not construct through wetlands during periods critical to waterfowl.

TransCanada's proposed route would not cross any areas known to support rare or endangered bird or wildlife species except along the Lac St-Jean route which supports raptors, of which only osprey are known to nest in the region. TransCanada stated that it intended to maintain a distance of 0.5 km from osprey nests and that it intended to verify the location of nests prior to construction.

#### Fish Resources

With the exception of the Lac St-Jean route which crosses many cold-water streams with salmonoid fish populations, the rivers crossed by TransCanada's proposed route support mainly warm-water fish species whose habitats have been affected by human activity. In many instances, the fisheries potential of these rivers has been limited by man-made factors.

TransCanada's environmental consultants provided a description of the fish population in the majority of rivers to be crossed by the proposed pipeline, as well as an identification of the rivers most sensitive to spawning. Times for construction of river crossings were recommended in order to minimize the impact on fish populations. TransCanada testified that its general policy is to accept these recommendations. TransCanada would conduct detailed site-specific studies at its proposed water crossings to determine how these sites are



being used by various fish species including the cold-water species along the Lac St-Jean route. It would conclude these studies, as well as any studies recommended by its consultants, prior to construction. Among the studies required are assessments of the impact of pipeline construction on sport fishing which is a major consideration on certain rivers such as the Richelieu.

During construction at river and stream crossings, TransCanada would protect the fish by limiting sedimentation which could affect fish spawning beds and by repairing or rebuilding any damaged spawning beds. TransCanada would also ensure that suitable fish passage structures were constructed where a blockage of a stream channel occurred or where the stream channel was displaced. When blasting, TransCanada would protect the fish by using air bubble curtains.

#### Toxic Substances

TransCanada stated that no pesticides or herbicides would be used without the approval of the provincial regulatory agency and the Board. Where it was necessary to use these substances, the Company testified that they would be dispersed mainly by low-pressure sprays applied at ground level.

Other toxic substances, such as fuels and lubricants, would be stored off the right-of-way, usually at the contractor's equipment yard. In the event of a spill of toxic substances, the contractor would be responsible for the clean-up and the Company would ensure that it was carried out.

#### Water Resources

Potential impacts upon water resources caused by pipeline construction can occur as a result of the route chosen, the trenching activities at river crossings and hydrostatic testing.

Ground water is a major source of water supply along the proposed routes and is used for agricultural, industrial, municipal and domestic use. The water quality is generally good. Where aquifers were crossed, the Company would ensure that all equipment was serviced away from the aquifers and that no fuel-storage depots would be set up. TransCanada would also prohibit liquid or solid wastes or fuels from



being deposited on the ground. All waste burial sites would be located so as not to contaminate aquifers. TransCanada testified that it would repair or replace any wells where the water supply was damaged during construction activities.

With respect to the proposed water crossings, the concerns are stream sedimentation and water contamination, and interference with recreational activities, fish spawning and water flow.

Generally, all river and stream crossings would be constructed as part of a mainline spread so as to utilize the heavy equipment already present. According to TransCanada's consultants, crossings should be constructed between January and February or between July and October. TransCanada testified that the Quebec Government also recommended certain times for construction across several rivers, and that this construction would take place within these recommended periods.

Pipe at river and stream crossings would be buried a minimum of 1.5 m below the original streambed and the trenches would be backfilled with material similar to the dredged material or with clean gravel.

To minimize disturbance to the waterways and to prevent excessive sedimentation, TransCanada would ensure that all materials and equipment were marshalled and prepared for installation prior to construction within the waterway, that trench spoil was deposited behind coffer dams and that, where practical, straw bales were used downstream of the crossing to filter any sediment. TransCanada would also install temporary earth plugs at the water's edge in order to prevent the land trench spoil from mixing with the stream water. When constructing in riverbeds composed of silt or clay, TransCanada would employ working mats to further minimize siltation. On completion of the crossing, the original river bottom configuration would be re-established.

Of the numerous crossings along TransCanada's proposed route, certain of them were considered by the environmental consultants as being particularly sensitive. On the routes through the Eastern Townships, the Richelieu River was cited as having significant historical and recreational importance. The consultants recommended that the river be crossed between 1 November and 31 March and that high aesthetic standards should be applied during construction and site-rehabilitation.

Along the mainline from St-Lazare to Quebec City, the most significant crossing would be the one proposed for the Lake of Two Mountains near Oka. This region is an extremely important recreational area, and supports both winter and summer sport fishing. TransCanada originally proposed a crossing at St-André-Est, but testified that a crossing at Oka would be environmentally more suitable as it would avoid important spawning grounds and waterfowl areas.

The construction at the Oka crossing is based on a seven-day week dredging schedule, and would take place over a five-month period commencing with clearing in April 1980. The crossing would consist of two 762 mm pipes installed in separate trenches with a minimum cover of four metres. Trenching would be accomplished with a bucket dredge.

TransCanada noted that there is a possibility of siltation of the beach area near its crossing, but this problem would be mitigated through a clean-up program.

TransCanada testified that, at the Oka crossing, the stream banks are sparsely wooded and that clearing would be required.

With respect to hydrostatic testing, TransCanada identified bodies of water that might be used, but had not yet selected its specific sites. When the selection was made, TransCanada would file the list of water bodies to be used with the Board.

Prior to using any water source, TransCanada would ascertain whether the flow rate was adequate to allow continuous filling of the pipeline without adverse impact on the aquatic habitat and resources. TransCanada would ensure that the rate of supply from any water body would not exceed one-third of the waterflow or cause any interference with downstream water uses or with the natural functions of the stream or river. TransCanada would attempt to maintain a minimum distance of 2 km from any downstream municipal water intake. When water used for testing is returned to a watercourse, TransCanada would use an energy-absorbing diffuser to prevent erosion and scouring of the adjacent bank.

#### Noise

The compressor stations to be built as part of TransCanada's system would house electric motors, engines or turbines depending on the requirements of each station. The major environmental concern associated

with compressor station operations is the problem of noise emission. TransCanada stated that its policy concerning the level of noise emissions originating from its compressor stations was that the maximum level would not exceed 55 dBA at its station property line. This level would not exceed any federal, provincial or local regulations concerning noise levels. Methods used to suppress the noise level below 55 dBA would include silencing the unit intake and exhaust, and insulating the building and the above-ground pipe.

#### Residual Impacts

The major long-term residual impacts of the proposed pipeline development are the visual impact of the linear features of the right-of-way through woodland areas and the loss of forest habitat and productivity.

Minor long-term residual impacts would result from disturbance due to pipeline maintenance and surveillance operations, particularly in residential areas and from the modification of future residential or industrial expansion and related infrastructure due to the location of the right-of-way.

The major short-term impact would be a loss of crops during construction and a reduction in agricultural productivity during the rehabilitation period which might range from one to five years.

Potential residual environmental impacts might result from disturbance of river beds, disposal of water during hydrostatic testing, slumping and mudflows in sloping terrain, and from a conflict between recreational activities and wildlife for the right-of-way corridor.

#### 6.1.6.3 Environmental Inspection, Supervision and Monitoring

##### Environmental Inspection and Supervision

TransCanada's Environmental Protection Practices Handbook which outlines the Company's environmental policies and procedures, would be distributed to TransCanada employees as well as to contractors and their personnel. TransCanada would hold environmental orientation sessions for contractors, their supervisors and foremen, and for environmental inspectors. These sessions would be given by persons trained and experienced in environmental matters.



During construction, TransCanada's environmental inspectors would inspect the operations for conformity with TransCanada's environmental policies and procedures. The inspectors would have a professional background in environmental studies and in inspection and monitoring.

One environmental inspector would be assigned to each spread. However, in agricultural zones, on very large spreads, or at river crossings, more environmental inspectors would be employed. They would be at the construction site throughout the daily activities and would consult, on a full-time basis, with other inspectors and with the contractors' personnel. The inspectors would report administratively to the construction supervisor and functionally to TransCanada's environment group.

Should an environmental inspector have a specific concern regarding the environmental impact of some construction activity, his normal course of action would be to contact TransCanada's head office where he could expect an immediate response to his concern. In an emergency situation, the inspector would have the authority to stop an activity he considered to be environmentally unsound.

#### Environmental Monitoring

During the operation phase, TransCanada would environmentally monitor the pipeline to ascertain the impact on the environment. The items to be monitored would include crop response, active erosion, soil settlement, drainage, weeds, survival of plantings, wildlife habitat, stones and aquatic habitat. The details of TransCanada's monitoring program are specified in its Environmental Protection Practices Handbook, and would apply as general procedures to be followed. However, where necessary, modifications to these general procedures would be made to meet special requirements.

During the operational phase, the pipeline right-of-way system would be patrolled weekly by air to identify locations requiring maintenance or other activities that might affect the pipeline operation.

In addition to observation from the air-patrol, periodic underwater inspections would be made of the river crossings.



#### 6.1.6.4 Views of Intervenors

Quebec indicated that the Bureau des Audiences Publiques des Services de Protection de l'Environnement (BAPE) co-ordinated public meetings at communities along the proposed route to inform the population of the nature of the gas pipeline projects and to obtain the views of the public and other interested parties. BAPE determined that there is no objection, in principle, to the expansion of natural gas facilities in the Province of Quebec. There were, however, several concerns expressed which related primarily to the impact of pipeline construction and operation upon agricultural lands and to the importance of locating the route along existing corridors. There was also widespread concern about ensuring that effective environmental control measures would be applied and enforced.

#### UPA

UPA stated that it was not opposed to the expansion of natural gas in the Province of Quebec. However, UPA noted that although its members would probably be the last to take advantage of this energy source, they stood the risk of major long-term negative environmental impacts on their lands as a result of the construction and operation of these pipelines.

UPA felt that during route selection, TCPL had considered all environmental factors except the disruption of their agriculturally productive lands. UPA strongly recommended that the Applicants discuss their routes with the farmers and that the routes be modified to take their concerns into consideration.

According to UPA, the option of following existing transportation corridors, rather than crossing through cultivated lands, had not been sufficiently examined and that prior to finalizing a route the feasibility of this approach should be studied further.

UPA noted that even if route changes were made, it would be impossible to avoid all agricultural lands. Depending on the construction methods used, the ensuing damage to these lands could be either minor or major, with possible long-term negative effects on land fertility and productivity. UPA claimed that while the Applicant gave

many assurances that construction techniques employed would minimize damage to the land, experience had shown that when working through contractors, these assurances were not always respected. To ensure that the proper construction methods were followed and that the Applicant's policies and procedures were obeyed, UPA recommended that the construction be overseen by someone outside the Applicant's employ and that these persons have the authority to force the Applicant and its contractors to abide by the Applicant's undertakings. UPA further recommended that the Applicant make its environmental policies, procedures and practices available to farmers, so that the farmer could, in part, oversee the work on his own land and be aware of the guidelines under which the contractors would be operating.

In addition to these general concerns, UPA also expressed numerous specific concerns regarding construction on cultivated lands. The first concern mentioned was that existing drainage systems must be maintained and that future drainage expansion activities must not be hampered. UPA recommended that specific guidelines be drawn up in order to avoid interference with existing drainage systems. UPA also proposed that all areas where existing drainage ditches could be deepened should be identified prior to construction and that the pipe should be buried at a sufficient depth to permit such future ditch expansion.

A second and very major concern dealt with soil compaction. According to UPA, compaction of soils when constructing during wet periods would have very serious and long-term detrimental effects on soil capability. UPA noted that the Applicant's proposed schedule avoided construction during the spring and autumn wet periods, but that a concern remained about construction during a wet period in the summer or during a winter thaw. UPA further noted that no specific policy had been outlined regarding construction at these times. One method UPA suggested to avoid excessive compaction was to insist that prior to trenching, all heavy equipment travel along the proposed centre line of the right-of-way.

A third matter of importance to agriculturalists is the preservation and restoration of topsoil. UPA recommended that topsoil be stripped from the entire working area and that the Applicant should

perhaps specify a minimum distance between the piled topsoil and the piled subsoil so as to prevent the mixing of the two. UPA also questioned the Applicant's policy on where it would place any unused spoil from the trenches.

UPA noted that TransCanada had specified that all stones from 10 cm up to 30 cm in diameter would be removed. UPA recommended that those sizes be changed to include all stones from 5 cm to 40 cm in diameter.

#### 6.1.6.5. Views of the Board

The Board has carefully considered TransCanada's environmental evidence and the views of the intervenors and the Board is satisfied that construction of the proposed pipeline system could be accomplished with minimal adverse environmental effect, provided the Company implements all the policies, environmental protection practices and procedures provided to the Board.

The Board accepts TransCanada's undertakings to follow the recommendations incorporated in the environmental impact assessment filed in support of its application. It also accepts the Company's commitment to complete ongoing work and to carry out further environmental impact assessments to identify appropriate mitigative measures should there be a change in the conditions under which the recommendations were made. The Board would require TransCanada, as a condition of a certificate, to report to the Board those recommendations that could not be implemented and to provide the reasons for the decision, the results of the impact assessment, and the alternative mitigative measures to be implemented.

While the Board accepts TransCanada's procedures and criteria for route selection, the Board is concerned about the potential impact from a multiplicity of transportation corridors through any one area. The Board would require the Company, when evaluating route realignments to minimize the adverse impact to agricultural land use, to submit for approval an evaluation of the practicality of following existing transportation corridors including a description of any constraints which would preclude this.



If it is not practical to follow existing corridors, the Board would require TransCanada to provide a description of all its proposed route realignments for minimizing the effect of the pipeline project upon agricultural land, together with a statement as to the reason for the realignment.

The Board reviewed TransCanada's undertakings to mitigate the effect of construction in marine clays, at river embankments and across wetland areas, and would expect the Company to implement these measures. In addition, prior to construction the Board would require, as a condition to a certificate, TransCanada to submit for Board approval the results of its proposed studies on unstable slopes, and the plans and procedures for stream embankment protection.

The Board is aware of the importance of agricultural land and the necessity for minimizing the negative effects of pipeline construction on agricultural land use and accepts, in general, TransCanada's measures to protect this resource including the measures proposed to maintain existing sub-surface drainage systems. The Board accepts the Company's proposal to construct the pipeline during those periods of the year when agricultural soil is either dry or frozen, and expects the Applicant to provide, prior to commencement of construction, a construction schedule which indicates that this undertaking is possible.

With respect to TransCanada's procedure for stripping topsoil from the ditchline and the spoil side of the ditch, the Board is willing to accept this procedure providing the Applicant ceases construction activities when the soil is excessively wet and that the subsoil on the working portion of the right-of-way is deep tilled during restoration to counteract any compaction that would have occurred during construction. The Board is also concerned that the topsoil pile and subsoil pile could become intermingled and, as a result, would expect TransCanada to provide the contractors with specific instructions to avoid such mixing and to ensure that these instructions are followed.

The Board is aware of concerns with respect to the depth of pipeline burial beneath surface drainage systems and the potential for



interference with operation and maintenance of these ditches. The Board would require the Company to provide guidelines on its construction methods to ensure that existing surface drainage systems are maintained and that future drainage expansion activities, such as ditch-deepening, would not be hampered.

The Board notes and accepts TransCanada's undertakings to minimize the effect of pipeline construction in forests and woodlots. Notwithstanding these assurances, the Board is concerned about the impact of pipeline construction upon sugar bush lots. The Board would require the Company, as a condition to a certificate, to reassess those portions of the pipeline route which traverse sugar bush lots and report to the Board, prior to commencement of construction, whether a route realignment to avoid the sugar-bush is practical, and if not, to provide the mitigative measures to minimize any adverse effects to the sugar bush and any operation associated with it.

The Board accepts TransCanada's plans and procedures, including its undertaking for further studies, for the protection of archaeological and historical resources.

The Board notes TransCanada's commitment to conduct site-specific studies at its proposed water crossings to determine the extent to which these sites were being utilized by different fish species, and to do assessment studies into the impact of pipeline construction on sport fishing. The Board would require the Applicant, as a condition of a certificate, to submit for approval by the Board, the timing of its construction activities at proposed water crossings, the results of its proposed studies and any resulting realignments.

The Board accepts the Applicant's undertaking that no pesticides or herbicides would be used unless approved by the Board and that other toxic substances such as fuels, lubricants, and pipe-coating compounds, would be stored and transported safely. The Board would expect the Applicant to implement these undertakings during construction.

The Board is satisfied that the Applicant is aware of its responsibility to ensure that wells and their water supplies are not seriously affected by construction activities and that the Applicant

would repair or replace any damaged wells. The Board accepts TransCanada's procedures for protecting municipal water supply sources its route would cross and would expect that the location of the municipal aquifers be provided to the contractors and the Board prior to the commencement of construction.

The Board notes that the Applicant has undertaken to file with the Board a list of waterbodies to be used as sources of water for hydrostatic testing. The Board would require the Applicant to file in addition to this list, a description of the location of municipal, industrial and domestic water intakes in relation to water withdrawal sites and the plans and procedures for monitoring water withdrawal and discharge to ensure that no impact occurs on aquatic habitat, fish resources or water users downstream. The Board would also require the Company to provide a statement of the precautions it would take to prevent the introduction of disease and parasites from one waterbody to another as a result of test-water disposal.

The Board notes and accepts TransCanada's policy that noise emission levels at compressor stations would not exceed 55 dBA at the station property lines. The Board would require the Applicant, as a condition of a certificate, to conduct noise level surveys at each compressor station under representative weather and land conditions, and to submit the results of the surveys to the Board to verify that the station noise emission levels meet the standard the Applicant set for these facilities.

The Board notes that TransCanada has undertaken to distribute its Environmental Protection Practices Handbook to all personnel on the project, and to conduct environmental orientation sessions for contractors, their supervisors and foremen, and for the environmental inspectors. However, the Board is concerned that there was no reference to an environmental orientation program having been planned for the construction workers on each spread who form the majority of the pipeline construction workforce and who in their jobs can have the greatest impact upon the environment. The Board would expect the Applicant, prior to commencement of construction, to implement a program for ensuring that

the construction workers are cognizant of the Company's environmental responsibilities.

The Board shares the concern of UPA for ensuring that the pipeline project is adequately inspected and monitored. Notwithstanding the Applicant's undertakings regarding environmental inspection of the project, the Board would ensure that its inspectors responsible for ensuring compliance with certificate and regulatory requirements would be on-site throughout the period of pipeline construction and that an adequate environmental monitoring program is in place.

The Board would require the Applicant to monitor the construction of the project and to report to the Board within six months of the completion of a season's work the results of the implementation of the plans and procedures undertaken by the Applicant for the protection of the environment. The report shall include a description of the effectiveness of these measures and any additional procedure which had to be implemented to prevent or mitigate adverse environmental effects.

The Board is pleased, however, to note that TransCanada would conduct a post-construction program of monitoring the effects upon the environment resulting from the construction and operation of the proposed facility. The Board would require, as a condition of a certificate, the Applicant to submit two reports satisfactory to the Board of the results of the Applicant's monitoring program.

## 6.2 Q & M

### 6.2.1 Location

#### 6.2.1.1 Description of Route Proposed by Q & M

Q & M proposed a mainline system commencing at Lévis/Lauzon, Quebec and extending to Halifax, Nova Scotia, with forty-four laterals and sub-laterals and four compressor stations. For both the export and non-export cases, the locations of the mainline and laterals are essentially the same; the differences lie in pipe sizes of the mainline and compressor horsepower requirements. Q & M's non-export case would eliminate two compressor stations and the St. Stephen lateral which has an export capability of  $7.08 \times 10^6 \text{ m}^3$ .

The general location of the proposed pipeline route and associated facilities are shown in Figure 6-2 in Appendix 6 and in Tables 6-10, 6-11, and 6-12.

#### 6.2.1.2 Route Selection

The route location took into account six broad areas of concern; population, costs, environmental, socio-economic, regulatory and technical factors.

Market specialists and engineers selected primary corridors. Next, environmental, socio-economic and geotechnical factors were considered. From this overview a program of progressive refinement of corridor location was established.

In order to have public input in its route selection process, Q & M reviewed its routing details with various local, regional and provincial authorities and discussed its findings at public meetings.

#### 6.2.1.3 Alternative Routes

Q & M provided the Board with a map showing the location of some of the alternatives that it had studied. The majority of these alternative routes were in New Brunswick because of scattered markets in that Province. Direct routes heading east, direct routes heading to the Fredericton area and direct routes to the export areas were evaluated.

The direct route across to the Chatham area and the alternative directly to Fredericton were both rejected for environmental reasons in order to avoid the headwaters of major rivers.



#### 6.2.1.4 Controversial Issues

The crossing of the Strait of Canso and the ADEQ and CRDEQ proposals that the Rivière-du-Loup/Matane area should receive natural gas service were subjected to discussion during the hearing.

The following sections summarize these two issues.

#### 6.2.1.5 Strait of Canso Crossing

Q & M considered an underwater crossing of the Strait of Canso for the Glace Bay lateral, but rejected this alternative because the deep excavation required to protect the lateral from ship anchors would make the crossing uneconomic. As a final choice, it proposed to cross the Strait on the southeastern shoulder of the Canso Causeway, a 1.25 km long transportation corridor connecting Cape Breton Island to the mainland of Nova Scotia, then at the east end to cross under a ship canal.

The Causeway was constructed of rock fill on which a two-lane highway, a 735 KVA power line, a telephone line, and a railway line were subsequently placed.

Q & M expressed confidence that necessary approvals could be obtained from the Nova Scotia Department of Highways, the Canadian National Railway and the Coast Guard for utilizing the Causeway to cross the Strait.

#### 6.2.1.6 ADEQ and CRDEQ Proposal

ADEQ proposed in its intervention that Q & M construct a lateral from La Pocatière to serve the communities of Rivière-du-Loup, Rimouski, Mont-Joli, and Matane. This proposal was also supported by the Province of Quebec which believed that the extension to the Matane area would provide an inexpensive source of energy and allow further economic development of the region.

At the Board's request, Q & M provided an economic feasibility study of serving eastern Quebec with natural gas. This study showed that the total capital cost of ADEQ's proposed lateral would be approximately \$15.4 million (1978 dollars) for 163.5 km of 168.3 mm O.D. pipeline and 65.0 km of 114.3 mm O.D. of pipeline with an annual forecasted market of  $88 \times 10^6 \text{ m}^3$  of gas in 1993. According to Gaz Métropolitain's studies, the total annual market potential in 1979 for the communities of Rivière-du-Loup, Rimouski, Mont-Joli and Matane could be  $185 \times 10^6 \text{ m}^3$ .

The addition of this lateral would have no significant impact on the upstream facilities between St-Lazare and La Pocatière.

In its submission, ADEQ alleged that the Rivière-du-Loup/Matane area was comparable to the New Brunswick northeastern area, which Q & M proposed to service. Q & M indicated that the proposed Newcastle lateral would cost about \$23 million (1978 dollars) but would transport about  $218 \times 10^6 \text{m}^3$  of gas in 1993. The unit capital cost based on the forecasted 1993 demand would then be about 40 percent less than the unit cost of the Rivière-du-Loup/Matane lateral.

Q & M decided not to serve the Rivière-du-Loup/Matane area at the present time because it did not consider it to be as profitable as other regions along its mainline. Q & M stated that it would continue to review the economics of serving this area.

Similarly, CRDEQ proposed a lateral to Matane but, in addition, it proposed that the lateral be extended through the Matapédia Valley as far as Campbellton, New Brunswick.

#### 6.2.1.7 Other Matters

Q & M testified that it had considered the possible production of gas from Sable Island, transporting  $7.08 \times 10^6 \text{m}^3$  per day, commencing November 1987. The location of the offshore and onshore pipeline has not been established by Q & M.

Q & M proposed to export  $7.08 \times 10^6 \text{m}^3$  per day from St. Stephen to the northeastern United States. According to Q & M, if the Lorneterm LNG Ltd. terminal near Lorneville, New Brunswick were installed, arrangements might be made to connect the proposed Tenneco Atlantic Pipeline near St. Stephen with the proposed export lateral.

#### 6.2.1.8 Views of the Board

The Board is satisfied that Q & M has properly considered alternative routes in selecting its mainline, lateral and sublateral sections.

With respect to the Strait of Canso crossing, the Board finds that further study by Q & M is required to prove the technical and economic feasibility of its proposal. Thus additional information would

be required concerning the nature of the core of the Causeway and of the material in the vicinity of the pipe along the Causeway; the techniques to be used for the trenching along the Causeway with particular details in the vicinity of the hydro towers; the techniques to be used to cross the two railroads and the ships' canal; and an economic comparison of the proposed Causeway crossing and the option of a conventional underwater crossing of the Strait of Canso.

With regard to the lateral proposed by ADEQ and CRDEQ to serve the Rivière-du-Loup/Matane area, the Board is in agreement with the Applicant that the construction of such a lateral cannot be economically justified at the present.

If a certificate were to be issued to Q & M, the Board would support the Applicant's commitment to keep under review the market demand forecasts of this area and the economic feasibility of such a lateral.

#### 6.2.2 Design and Capacity

##### 6.2.2.1 Design Methodology

Q & M's mainline section between Lévis/Lauzon and Sussex junction was designed to meet the 1992-93 average winter day requirements in the Maritimes. The balance of Q & M's mainline, that is between Sussex junction and Halifax, was designed to satisfy the 1992-93 peak winter day requirements of the markets downstream of Sussex junction, excluding the interruptible gas delivery to the thermal plants in Nova Scotia.

For the export case, Q & M proposed a mainline from Lévis/Lauzon to Halifax, with pipe sizes and operating pressures as shown in Table 6-11.

Q & M's economic study showed that this mainline design was selected on the basis of lower capital cost, lowest cost of service, higher system reliability and future system expansion possibilities in comparison with alternatives.

For the export case, Q & M proposed that the laterals and sub-laterals would range in size from 114.3 mm to 660.0 mm (see Table 6-13). These pipe sizes were determined by:



- (1) the forecast 1992-93 peak day flow capacity,
- (2) a minimum delivery pressure of 2 760 kPa (gauge) for the Maritimes, and 6 200 kPa (gauge) at the St. Stephen export point,
- (3) 10 percent spare capacity, and
- (4) a minimum line size of 114.3 mm.

For the export case, Q & M proposed a total of four compressor stations (exclusive of the compression requirement for underground storage), with a total of 22 732 KW, for the operating year 1989-90. Two stations would be located in Quebec and two in New Brunswick. Q & M proposed to install multiple compressor units at each compressor station to reduce initial investment and to achieve higher system reliability.

In Quebec, Q & M proposed to install two electric motor-driven compressor units and a gas turbine-driven centrifugal compressor unit at each compressor station for the operating year 1989-90. In New Brunswick, gas turbine-driven reciprocating compression units were proposed; three at Station No. 6 and two at Station No. 7.

Evidence indicated that the amount of horsepower required for a design day flow condition in operating year 1989-90 would be approximately 35 percent of the available horsepower or the equivalent of one unit at each compressor station. Q & M stated that the spare electric unit would be required to protect against a breakdown of the operating electric unit and that the spare gas unit would be provided to protect against a breakdown of the two electric units or power supply failures. Q & M did not take into account the number and duration of possible power supply failures in Quebec in its compressor station design.

At the request of the Board, Q & M submitted a system reliability study of its mainline system. The study revealed for the export case that if there were one spare electric or gas unit available at each station, there would be no reduction in the system capacity, even with the loss of one unit during the most critical month of the operating year 1989-90. In the event of a line break or power supply failure at a



compressor station, additional gas would be made available from the underground storage facilities in New Brunswick by reversing the gas flow.

For the export case, Q & M proposed the construction of cavern facilities for underground gas storage at Sussex, New Brunswick, to satisfy peak requirements and shortfalls between supply and demand. According to the design basis, gas would be injected into the caverns for storage during the off-peak summer season and withdrawn during extremely cold winter days, at average injection and withdrawal rates of  $0.9 \times 10^6 \text{m}^3$  per day and  $9.9 \times 10^6 \text{m}^3$  per day, respectively. The storage requirement corresponding to these injection and withdrawal rates would be  $158.6 \times 10^6 \text{m}^3$  according to Q & M, rather than the  $178.5 \times 10^6 \text{m}^3$  it originally proposed. Use of the storage facilities would not be required until 1986-87.

Design considerations for underground facilities are included in the description of these facilities in a later section of this report.

For the non-export case, Q & M proposed pipe sizes and operating pressures as shown on Table 6-11. This mainline design was selected over alternatives on the basis of lower capital cost and lowest cost of service. Identical laterals and sub-laterals were proposed as for the export case, except for the elimination of 85.3 km of the St. Stephen export lateral and the reduction in size of the Saint John lateral from 660.0 mm to 219.1 mm.

For the non-export case, Q & M proposed a total of two compressor stations, each with two compressor units, for a total of 4 249 KW for the operating year 1989-90. One station with one electric unit and one gas unit, would be located in Quebec and the other with two gas units, in New Brunswick. Evidence showed that there would be no reduction in maximum day capacity, even with the loss of the most critical unit on the system.

For the non-export case, Q & M proposed underground storage cavern facilities at Sussex, New Brunswick. During the hearing, Q & M stated that  $212.5 \times 10^6 \text{m}^3$  of underground storage capacity would be required by 1989-90 rather than the  $303.1 \times 10^6 \text{m}^3$  proposed in the application. Prior to 1989-90, there would be no need for storage.

Table 6-11

Q & M  
SUMMARY OF MAINLINE FACILITIES

Export Case									
Section	Pipe Length (km)	Pipe Size (mm)	MOP kPa (gauge)	Compressor Station		No.	Compressor Station Unit		
				No.	Location		Type	Size (kW)	Year of Construction
Lévis/Lauzon to Saint John Jct.	464.8	610	8270	3	St-Aubert, Québec	1	electric	2236	1983
						1	electric	2236	1986
						1	gas	2795	1983
					Lac Thibeault, Québec	1	electric	2236	1983
						1	electric	2236	1986
						1	gas	2795	1983
					Sweeney Corner N.B.	2	gas	2236	1983
						1	gas	2236	1985
Saint John Jct. to Sussex Jct.	86.6	508	8270	1	Petitcodiac N.B.	2	gas gas	745	1984
Sussex Jct. to Glace Bay Jct.	185.2	355.6	8270	-	-	-	-	-	-
Glace Bay Jct. to Halifax	129.9	323.9/ 219.1	8270	-	-	-	-	-	-
St. Stephen Lateral	104.4	660	8270	-	-	-	-	-	-

Table 6-12

Q & M  
SUMMARY OF MAINLINE FACILITIES

Non-Export Case

Section	Pipe Length (km)	Pipe Size (mm)	MOP kPa (gauge)	Compressor Station		No.	Compressor Station Unit		
				No.	Location		Type	Size (kW)	Year of Construction
Lévis/Lauzon to Saint John Jct.	464.8	457	8270	1	Sully, Quebec	1	electric	1864	1984
						1	gas	895	1984
Saint John Jct. to Sussex Jct.	86.6	457	8270	1	Jemseg, N.B.	2	gas	745	1986
Sussex Jct. to Glace Bay Jct.	185.2	355.6	8270	-	-	-	-	-	-
Glace Bay Jct. to Halifax	129.9	323.9/ 219.1	8270	-	-	-	-	-	-
St. Stephen Lateral	19.1	219.1	8270	-	-	-	-	-	-

Table 6-13

Q & MDESCRIPTION OF LATERALS AND SUB-LATERALS IN NEW BRUNSWICK AND NOVA SCOTIA

<u>Area Served</u>	<u>Pipe Length</u> (km)	<u>Pipe Size</u> (mm)	<u>Construction</u> <u>Year</u>
Bathurst, N.B.	33.95	168.3	1982-83
	3.38	114.3	1982-83
Belledune, N.B.	45.98	219.1	1982-83
	6.43	114.3	1982-83
Campbellton, N.B.	131.64	219.1	1983
	5.95	168.3	1983
Chatham, N.B.	61.47	168.3	1982-83
	5.47	114.3	1982-83
Dalhousie, N.B.	18.51	219.1	1983
	7.55	114.3	1983
Edmundston, N.B.	1.93	114.3	1981-82
Fredericton, N.B.	9.33	114.3	1981
Fredericton North, N.B.	6.43	114.3	1981
Grand Bay, N.B.	6.76	168.3	1981
	1.93	114.3	1981
Havelock, N.B.	14.64	114.3	1981
Moncton, N.B.	13.84	168.3	1981-82
Nackawic, N.B.	14.00	114.3	1981
Newcastle, N.B.	6.28	114.3	1982-83
Oromocto, N.B.	6.60	114.3	1981
Sackville, N.B.	4.67	114.3	1981-82
Saint John, N.B.	11.59	168.3	1981
St. Stephen, N.B.	85.30	660.0 <sup>(1)</sup>	1982-83
	19.15	660.0 <sup>(2)</sup>	1981
Sussex, N.B.	5.47	114.3	1981
Westfield, N.B.	60.82	219.1	1981
	1.77	114.3	1981
Amherst, N.S.	4.02	114.3	1981-82



Table 6-13 (continued)Q & MDESCRIPTION OF LATERALS AND SUB-LATERALS IN NEW BRUNSWICK AND NOVA SCOTIA

<u>Area Served</u>	<u>Pipe Length</u> (km)	<u>Pipe Size</u> (mm)	<u>Construction</u> <u>Year</u>
Antigonish, N.S.	55.05	273.1	1982-83
	3.22	114.3	1982-83
Dartmouth, N.S.	18.67	273.1	1981-82
Glace Bay, N.S.	110.09	219.1	1982-83
	18.34	168.3	1982-83
New Glasgow, N.S.	6.28	273.1	1982-83
	3.70	114.3	1982-83
North Sydney, N.S.	20.11	168.3	1982-83
Port Hawkesbury, N.S.	51.01	273.1	1982-83
	6.43	114.3	1982-83
Springhill, N.S.	10.30	114.3	1981-82
Stellarton, N.S.	51.35	273.1	1982-83
	2.89	114.3	1982-83
Sydney, N.S.	2.25	168.3	1982-83
	2.41	114.3	1982-83
Truro, N.S.	<u>5.31</u>	114.3	1981-82
	962.22		

Note: (1) For the non-export case, this lateral will be eliminated.

(2) For the non-export case, this lateral size will be reduced to  
219.1 mm

#### 6.2.2.2 Geotechnical Design

In its design and cost estimate Q & M took account of terrain problems, soil-pipe interaction and mitigative measures necessary to construct a safe and reliable pipeline. It identified, for instance, bogs and swamps so that the construction cost estimate could include the costs of rafts or special access roads. Similarly, in areas of high watertable, it identified locations where buoyancy control measures and drain tiles would be needed, and where construction schedules would be affected during prolonged wet weather conditions. It identified, also, the locations of substantial bedrock where extensive blasting and rock ditching would be required.

In highly sensitive marine clays, Q & M stated that, where required, special measures would be taken to ensure slope and trenchwall stability and prevention of bottom heave, and hence protect the structural integrity of the pipeline.

Q & M had identified potential slope problems, and slope stabilization measures, as warranted, would be undertaken.

In swamp areas near the sea where the pipeline would be regularly flooded by tide, Q & M stated it would incorporate in its design proper pipe wrapping and cathodic protection to prevent salt water corrosive action. Similarly, in these areas, proper weighting of the pipeline would be applied either to counteract the pipeline uplift buoyancy force or to prevent sinking of the pipeline in these low-bearing, underconsolidated deposits.

The pipeline would be designed to accommodate the strains due to seismic activity. Where the pipeline crossed a fault, the walls of the ditch would be sloped and good quality backfill would be used.

#### 6.2.2.3 Materials Engineering

In the preliminary stress analysis of the proposed pipeline, representative soil parameters were used. The Applicant proposed to use specific field parameters, where justified, in determining final design requirements.

Q & M considered fracture initiation and brittle and ductile fracture propagation in its fracture control design of the pipeline. Q & M specified a 60 percent minimum and an 85 percent average shear area on the drop weight tear test specimen at the design temperature. This specification intended to prevent brittle fracture initiation and propagation. For the components operating at 60 percent or less of the yield strength, a minimum 50-percent shear area at the design temperature was specified. Q & M has demonstrated that the specified minimum Charpy absorbed energy would minimize ductile fracture initiation, and that the specified average Charpy absorbed energy would limit the maximum fracture length to less than 60 m.

For the preparation of the final material specifications Q & M would use the Board's Gas Pipeline Regulations, the 1979 edition of CSA-Z184 Standard and the metric editions of CSA-Z245.1 to .5 and .10 Standards, as well as the AGTL Specifications which were submitted in the application. Q & M undertook to submit the finalized specifications sheets for line pipe and components to the Board for approval.

Q & M stated that it was evaluating its position relating to the formulation of specifications for the engineering critical assessment of girth welds. It was conducting experiments to verify the analytical methods pertaining to the critical assessment for girth welds and would submit to the Board the results of these experiments as well as the associated calculations.

Q & M would radiographically inspect the full circumference of all girth welds on mainline and lateral lines.

#### 6.2.2.4 Construction

For the non-export alternative, construction of the Q & M project (excluding underground storage) would be scheduled over a thirty-month period, commencing in the summer of 1981 and finishing in October 1983, with eleven spreads working in five construction seasons. In order to meet this schedule, Q & M allowed for advance clearing in heavily wooded areas, and/or rock grading in areas of rough rock relief.

According to Q & M, the construction of the mainline facilities to Halifax, certain laterals for domestic use, and the export lateral to St. Stephen, would be completed by November 1982.

Q & M stated that the pipeline facility would be constructed using conventional summer construction techniques, but in certain areas where numerous bogs or swamps exist, winter construction might be undertaken.

#### 6.2.2.5 Operation and Maintenance Procedures

Q & M proposed to operate and maintain its facilities from a Head Office located in Quebec, Divisional Offices located in New Brunswick and Nova Scotia, and five District Offices. There would be no duplication of services provided by TCPL for the system facilities located in Quebec.

The Head Office would include a continuously-attended control centre exercising remote-controlled operation over Q & M's facilities, including the underground storage facilities and compressor stations. The compressor stations would be designed to provide a fail-safe mode of operation, to allow start-up and/or shutdown of individual units or station, and adjustment of set points. All stations would be unattended, with maintenance provided by a mobile crew.

Right-of-way patrols would be regularly carried out by fixed-wing aircraft. More frequent patrols, some by low-flying helicopters, would be made during the spring thaw and period of heavy rainfall. Regular right-of-way maintenance would be conducted by Company personnel, assisted in some cases by locally contracted services.

Training in operating procedures would be provided to all operating personnel. Manuals would be prepared covering system operating procedures, maintenance, safety and emergency planning.

#### 6.2.2.6 Electrical Interference Problems

Q & M prepared a list of the distances over which various size pipelines were adjacent to or closely parallel existing or proposed power lines operating at 69 KV or above. It further stated that joint use of power line and pipeline rights-of-way was anticipated only at crossings,



which were enumerated, and possibly in a few isolated locations where features such as difficult terrain would make joint use necessary.

The mitigation of electrostatically induced voltages during construction and electromagnetically induced voltages during operation of the pipeline in these areas were addressed in the report "Induced Voltages in Pipelines from High Voltage Power Lines, September 1979", filed at the hearing. In addition the Applicant stated that currents would be limited to those levels recommended by the National Association of Corrosion Engineers in their recommended practice RP-01-77. Furthermore, in those areas determined as being hazardous, the pipeline would be treated as a live conductor requiring the use of rubber boots and gloves for the protection of personnel. It was also Q & M's intention to cooperate with the affected utilities in order to determine the hazardous locations along its pipeline with respect to these induced voltages or for ground faults on the adjacent power transmission lines.

Inspectors would be on site who would be responsible for the electrical safety of the public and personnel during construction. They would have the authority to designate the proper safety procedures or interrupt the construction of the line until adequate precautions are taken. The inspectors would also be provided with special construction procedures to be used in areas of construction adjacent to power lines. Standard working clearances as specified by provincial regulations or Workman's Compensation would be applied on a province by province basis.

#### 6.2.2.7 Peak Shaving Facilities

Q & M proposed underground storage facilities at Smith Creek, a small community near Sussex, New Brunswick. The location of this underground storage system is illustrated in the map at Appendix B of this report.

Q & M stated that a 404.6 hectare site near Smith Creek was selected for the development of underground storage facilities because of the existence of large salt deposits in that area. The location of the proposed site would be about 3.2 km away from the closest residence and it would be easily accessible, relatively flat and would be close to

roads, rail and other utilities. The site would not conflict with existing mining concessions in the area. Sufficient fresh water required for solution mining would be withdrawn from the nearby Kennebecasis River situated about 14.3 km from the storage area and the waste water from the operation would be pumped into the Bay of Fundy located about 46.6 km away.

In order to determine the location of suitable salt deposits, Q & M first conducted a literature search, then examined the seismic and gravity records of the New Brunswick Department of Mines and Energy. In addition, Q & M retained three consultants to assist it in the selection of a suitable location and the evaluation of salt storage development.

The preliminary design of the underground storage was based on available data from two boreholes, one at Penobsquis and the second one at Plumswessep.

The final selection of the location of the cavern would be made only after a thorough exploratory drilling program to confirm the physical characteristics of the salt deposits. Q & M stated that in the event that this location could not be developed for technical or economic reasons, an alternative site at Dorchester, about 80 km east of Sussex, would be investigated.

The cost of developing these facilities was estimated to be \$34 million 1979 dollars for the export case and \$41.7 million 1979 dollars for the non-export case.

For both the export and non-export cases, Q & M stated that the water system requirements for solution mining would consist of a fresh-water intake structure, a supply line of 14.3 km, a brine line of 46.5 km (to the Bay of Fundy) with an outfall structure, and two pumping stations. Five 984.3 kilowatt reciprocating compressors would also be required. The proposed rate of development for the export case would be two caverns ( $28.3 \times 10^6 \text{ m}^3$  each) for every 30-month period whereas for the non-export case, this rate would be doubled for the same period. It would take approximately six years to develop 10 caverns in the non-export alternative and seven and one half years to develop six ( $28.3 \times 10^6 \text{ m}^3$  each) caverns for the export alternative.

Gas would be injected into the caverns during the summer and withdrawn during the winter when the demand was high. For the non-export case, Q & M proposed that underground capacity of  $212 \times 10^6 \text{m}^3$  (excluding cushion gas) would be required by 1989-90. For the export case, the facilities are designed to withdraw gas at a maximum rate of  $9.9 \times 10^6 \text{m}^3$  and the capacity of underground storage would be  $158 \times 10^6 \text{m}^3$ . There would be no need for storage until 1989-90 for the non-export case, and 1986-87 for the export case. The details of injection and withdrawal rates for both export and non-export alternatives are shown in Table 6-14.

Table 6-14

Q & M

DESIGN GAS INJECTION AND WITHDRAWAL RATES PER DAY FOR UNDERGROUND  
STORAGE FACILITIES

(a) <u>Export Case</u>			
<u>Gas Year</u>	<u>Injection Rate (<math>10^6 \text{m}^3</math>)</u>	<u>Peak Withdrawal Rate (<math>10^6 \text{m}^3</math>)</u>	<u>Total Storage Capacity Excluding Cushion Gas (<math>10^6 \text{m}^3</math>)</u>
1980-81	-	-	-
1981-82	-	-	-
1982-83	-	-	-
1983-84	-	-	-
1984-85	-	-	-
1985-86	0.58*	-	-
1986-87	0.20	0.85	118.9
1987-88	0.23	1.13	118.9
1988-89	0.88	1.27	118.9
1989-90	0.88	2.83	158.6

(b) <u>Non-Export Case</u>			
<u>Gas Year</u>	<u>Injection Rate (<math>10^6 \text{m}^3</math>)</u>	<u>Peak Withdrawal Rate (<math>10^6 \text{m}^3</math>)</u>	<u>Total Storage Capacity Excluding Cushion Gas (<math>10^6 \text{m}^3</math>)</u>
1980-81	-	-	-
1981-82	-	-	-
1982-83	-	-	-
1983-84	-	-	-
1984-85	-	-	-
1985-86	-	-	-
1986-87	-	-	-
1987-88	-	-	-
1988-89	1.19*	-	-
1989-90	1.19	1.84	212.5

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\* Including allowance for initial filling of caverns.

#### 6.2.2.8 Views of the Board

With regard to design methodology, geotechnical design, materials engineering, construction, operations and maintenance, electrical interference, peak shaving facilities, the Board has made the following findings:

##### Design Methodology

The Board agrees with Q & M's design for:

- (a) the mainline for the export and non-export cases;
- (b) the lateral lines; and
- (c) the St. Stephen export line.

With respect to the compression required for the export case, the Board is of the opinion that the spare horsepower should be equivalent to that amount of horsepower required for a design day flow condition. The Board is not persuaded by Q & M's arguments seeking to justify spare compression at each station of 200 percent of the horsepower required for a design day flow condition particularly in view of the knowledge that TCPL has operated electric motor-driven compressor units on its Toronto to Montreal mainline for years without spare units.

If a certificate were to be issued to Q & M, it should only be for the mainline compression facilities required to meet Q & M's forecast market demand for the year 1984/85, rather than those required to meet the market demand up to the operating year 1989/90 as proposed by Q & M. Consequently, for the export case, only the construction of mainline compressor stations at St-Aubert, Quebec (one gas turbine unit and one electric unit), Lac Thibeault, Quebec (one gas turbine unit and one electric unit), Sweeney Corner, New Brunswick (two gas reciprocating units) and Petitcodiac, New Brunswick (two gas reciprocating units) would be certified initially. For the non-export case, the construction of the mainline compression station at Sully, Quebec (one electric unit) would be approved.

In reaching such conclusions, the Board realizes that additional compression facilities might be required for Q & M's proposed system within a few years following completion of construction. If so, the Applicant would be in a better position to assess the market



potential and to design the additional compression facilities accordingly. Therefore, the Board feels that the decision to construct the additional facilities should be deferred.

With respect to the proposed underground storage facilities near Sussex, New Brunswick, the Board concludes that their construction should not be approved at the present time in view of the absence of evidence indicating that an early construction start, at least prior to 1984, is required or desirable. The Board, therefore, feels that the consideration of these facilities should be deferred until such time as a report, including more precise gas market demand forecasts and results of a drilling program, attesting to the feasibility of the underground storage project could be submitted for its consideration.

#### Geotechnical Design

The Board notes that Q & M has taken into account geotechnical considerations in designing and cost estimating its pipeline system.

Although considerable variation exists in the type of overburden and bedrock, the Board is satisfied that the nature of the materials to be traversed by the proposed pipeline and their geotechnical parameters are known from past research and experience. The Applicant has undertaken to make further site specific studies after the granting of a certificate. These studies would serve as the basis to the final design.

#### Materials Engineering

The Board finds the preliminary stress analysis acceptable, and is satisfied that the specified fracture toughness values minimize the probability of fracture initiation and propagation. Similarly, the preliminary materials specifications filed in the application are considered acceptable. However, the Board would require that the final specification sheets for line pipe and components be submitted to the Board for approval before the final design is completed.

The Board would also require that the girth welds meet the requirements of the CSA Z184-M1979. It is, however, prepared to review the reports, if submitted, on experiments and associated calculations conducted by Q & M in relation to the critical assessment of the girth welds.

The Board fully supports the Applicant's stated intention to perform 100 percent radiographic inspection on all circumferential welds.

#### Operation and Maintenance

The Board is satisfied with the preliminary procedures for the operation and maintenance of the proposed facilities, as submitted by Q & M.

If a certificate were to be issued to Q & M, the Board would require from Q & M a study on the merits of unattended operation of its compressor stations as opposed to manual operation of these facilities.

#### Electrical Interference

The Board is satisfied that proper precautions would be implemented to mitigate electrical interference during the construction and operation of the pipeline.

#### Peak Shaving Facilities

The Board is not prepared to accept the design of the underground salt cavern until a confirmatory drilling program demonstrates the technical feasibility of constructing such proposed underground storage.

In addition, the Board notes that there is no need at this time to construct the underground storage facilities which would be needed only in the 1989/90 period.

#### Construction

The Board is of the opinion that the construction schedule, as proposed by Q & M, is feasible. The Board notes that possible threats to that schedule might arise if a shortage of skilled manpower developed as a result of competition from other major pipeline construction projects planned for the same period (1980-1984), or if unusually prolonged summer rains occurred, especially in marine clays or in areas having a high watertable.

#### 6.2.3 Cost of Facilities

##### 6.2.3.1 Cost of Maritimes Transmission Facilities

Q & M provided cost estimates for the export and non-export cases. (The design assumptions for these two cases are discussed in section 6.2.2.1 of this report.)

Q & M provided detailed estimates of its facilities based on data obtained from suppliers, manufacturers, contractors, consultants and the staff of Alberta Gas Trunk Line. Its final estimates were prepared after discussions with TCPL after the applications were amended and made complementary. Labour rates were obtained from the 1978 collective agreement for the pipeline construction trades.

Q & M estimated the total cost in 1979 dollars for the export and non-export facilities, as required to meet the market demand in the gas year 1989/90, at \$425.5 million and \$337.2 million respectively.

Table 6-15 is a summary of the 1979 dollars construction costs of the total Q & M facilities.

Table 6-15

Q & M ESTIMATED TOTAL COST OF FACILITIES

	<u>(\$1979 millions)</u>	
<u>Direct Cost</u>	<u>Export</u>	<u>Non-Export</u>
Pipeline	\$271.755	\$208.270
Compressor Station	28.845	7.062
Meter Station	3.799	3.297
Peak Shaving	34.375	41.695
Other Facilities <sup>(1)</sup>	<u>17.474</u>	<u>17.278</u>
Sub-Total Direct Costs	<u>\$356.257</u>	<u>\$277.602</u>
<u>Indirect cost</u>		
Pre-permit	\$ 10.100	\$ 10.100
Engineering	21.375	16.913
Management & Overhead	13.511	13.148
Contingency	18.881	15.386
NEB Monitoring	3.349	2.629
O & M <sup>(2)</sup> Prior to Service	<u>1.589</u>	<u>1.421</u>
Sub-Total Indirect Costs	<u>\$ 68.805</u>	<u>\$ 59.597</u>
TOTAL	<u>\$425.062</u>	<u>\$337.199</u>

(1) Includes division and district and communication facilities, and land and land rights costs.

(2) Operations and Maintenance

In both the export and non-export cases, the costs shown in Table 6-14 included the construction of facilities in Quebec (from the junction with TCPL's proposed facilities near Lévis/Lauzon to the Quebec/New Brunswick border), New Brunswick (including the underground storage facilities) and Nova Scotia.

Under the export case, the cost of facilities in 1979 dollars would be approximately \$78 million in Quebec, \$272 million in New Brunswick and \$75 million in Nova Scotia. For the non-export case, the cost of facilities in 1979 dollars would be approximately \$59 million in Quebec, \$201 million in New Brunswick and \$77 million in Nova Scotia.

The material and labour represent 57 percent and 43 percent, respectively, of the total cost.

The cost of the first  $28 \times 10^6 \text{ m}^3$  of underground storage was estimated to be \$25 million (1978 dollars). Each additional cavern ( $28 \times 10^6 \text{ m}^3$ ) was estimated to cost \$1.5 million. The cost for the underground storage facilities includes cavern development compressor facilities, dehydrator, meter station, and a water handling system.

The item, "NEB Monitoring" in Table 6-14 was arbitrarily set at one percent, since no previous experience with this cost existed.

Based on inflation rates ranging from 11.8 percent in 1979 to 5.3 percent in 1990, Q & M estimated that the "escalated" costs of its total project, not including allowances for funds used during construction, would be \$533.7 million for the export case and \$421.1 million for the non-export case.

#### 6.2.3.2 Cost of Maritimes Distribution System

Since no operating natural gas distribution facilities existed in New Brunswick and Nova Scotia except at Moncton, New Brunswick, Q & M developed a representative distribution design for each community.

The Applicant included peak hour shaving facilities in its design for each market area. These facilities represented between seven and nine percent of the total capital cost of the distribution systems in the Maritimes.



Cost estimates were based on the experience of existing distribution companies, quotations from major suppliers in Canada and construction costs of other local public utilities. The total capital cost of distribution in the Maritimes to year 1990 was estimated to be \$118.8 million in 1979 dollars (see Table 6-16).

The Applicant did not include any conversion costs in its original application. It recognized, however, that due to gas price discounts, the distributor might be allowed to employ various marketing tools, one of which might cover a portion or all of the customer's conversion costs. Subsequently, conversion costs were provided by the Applicant during the course of the hearing.

Conversion to natural gas was assumed to be from oil only. A residential cost of conversion of \$600 per dwelling unit was assumed in the residential market sector. Conversion costs for commercial customers were related to the size of the commercial establishments. In the industrial sector, an average boiler size was estimated and the conversion costs were calculated accordingly. Since no detailed engineering study was not made for the four thermal electric generating units to be converted in Nova Scotia, the conversion costs of these units were derived from data available for various sizes of industrial boilers.

The total conversion costs, to the year 1990 were estimated to be \$43 million in 1979 dollars (see Table 6-17).

During the hearing, distribution cost estimates to the year 1992 were submitted by Inter-City for New Brunswick and by ICG Scotia for Nova Scotia. The costs were estimated to be \$153 million and \$165 million respectively in 1979 dollars. The demand forecast by Inter-City and ICG Scotia was 2.6 times higher in New Brunswick and 1.7 times higher in Nova Scotia than the forecast by Q & M.

The Province of Nova Scotia also submitted capital cost estimates for distribution systems in Nova Scotia to year 2000. Under its base case, a total investment of \$91 million, in terms of 1979 dollars, would be required to deliver  $1.5 \times 10^9 \text{ m}^3$  in year 2000.

The Province also estimated a high forecast case, where a total investment of \$114 million, in 1979 dollars, would be required to deliver  $1.7 \times 10^9 \text{ m}^3$  in year 2000.

Table 6-16Q & MMARITIMES DISTRIBUTION COSTS(\$1979 thousands)

	<u>New Brunswick</u> <sup>(1)</sup>	<u>Nova Scotia</u> <sup>(2)</sup>	<u>Total</u>
1981	4,508	3,093	7,601
1982	11,552	10,601	22,153
1983	9,012	10,118	19,130
1984	5,529	6,878	12,407
1985	4,296	5,251	9,547
1986	8,321	11,608	19,929
1987	3,433	3,977	7,410
1988	3,277	3,853	7,130
1989	3,188	3,720	6,908
1990	3,082	3,541	6,623
TOTAL	56,198	62,640	118,838

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(1) and (2) From Exhibit # 22-108, Tables 11 and 12

Table 6-17Q & MMARITIMES CONVERSION COSTS(\$1979 thousands)

	<u>New Brunswick</u> <sup>(1)</sup>	<u>Nova Scotia</u> <sup>(2)</sup>	<u>Total</u>
1982	2110	3853	5963
1983	2481	2619	5100
1984	2141	2782	4923
1985	1989	2373	4362
1986	2055	2520	4575
1987	2059	2493	4552
1988	2103	2505	4608
1989	2101	2512	4613
1990	2117	2520	4637
TOTAL	19,156	24,177	43,333

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(1) and (2) From Exhibit # 22-137, Tables 1 and 2

### 6.2.3.3 Views of the Board

With regard to the cost of transmission facilities, the Board is of the opinion that:

- (a) subject to final design changes resulting from site-specific terrain analysis, Q & M's cost estimates appear to be reasonable;
- (b) the escalation rates used for the construction years 1980 to 1987 are somewhat low, in view of the envisaged growth in pipeline facilities construction during those years;
- (c) the escalated cost of the total project would likely be \$75 to \$100 million higher than estimated by the Applicant;
- (d) if Q & M's application is certificated, the proposed facilities, excepting the underground storage facilities, should be approved to the end of construction year 1984 for either the export or non-export cases; and
- (e) based on Board estimates, the cost of the Maritimes transmission facilities (1979 dollars) excluding underground storage and construction after 1984, would be \$378.8 million for the export case and \$269.7 million for the non-export case.

With regard to the estimated cost of distribution and conversion, the Board finds that the methodology proposed by Q & M is acceptable under its market assumption.

The Board recognizes that the distribution costs submitted by Inter-City and ICG Scotia for the Provinces of New Brunswick and Nova Scotia represent other valuable estimates for the respective market demand projections.

Similarly, the Board accepts the estimates of the distribution costs submitted by the Province of Nova Scotia for its indicated market projection.

### 6.2.4 Right-of-Way (Q & M)

#### Introduction

The following sections of the report outline the policies and procedures proposed by Q & M for acquiring the necessary rights-of-way to construct the proposed pipeline and underground salt cavern storage facility.

Q & M obtained information on land uses along the proposed route that could be incompatible with pipeline construction such as urban areas, Indian lands, and mining areas. This information was evaluated along with the concerns expressed by relevant government agencies and affected landowners in order to determine the preferred route. Following route selection, Q & M initiated its land acquisition procedures and formulated plans for compensation.

#### 6.2.4.1 Land Use

##### Infrastructure

Q & M stated that during initial design, highways and railroads were investigated as possible routing alternatives but that the use of existing transportation corridors could present problems.

Q & M testified that it had not established a minimum cover for areas where the proposed pipeline would be constructed within public corridors such as road allowances. The Applicant gave evidence that it would maintain a minimum of 60 cm of cover as set out in the CSA Standard Z184-M1979. Q & M stated that it could foresee circumstances where additional cover requirements, in excess of the minimum code requirement, would be required in public rights-of-way.

##### Areas of Urban Development

Q & M indicated that the proposed construction near urban land could lead to temporary disruptions, but any long-term effects of pipeline construction would generally be related to limitations on future patterns of development.

Q & M indicated that the land near the right-of-way must be restricted to compatible functions but testified that a pipeline company had no right to restrict the use of the lands adjacent to the right-of-way. The easement form sets out certain restrictions for the use of the proposed pipeline right-of-way.

Q & M gave evidence that the proposed pipeline would generally be located away from existing or potential built-up areas. The Applicant noted that industrial parks could be serviced from the edge of the park as adequately as by going through the middle, thereby avoiding the disruption caused by a right-of-way through the area. The Applicant



testified that on final design any city-gate stations that had been inadvertently located in a residential area would be relocated.

The Applicant stated that where the pipeline must be built close to buildings, heavy wall pipe would be installed in conformity with the Board's Gas Pipeline Regulations. Q & M testified that should the area surrounding the right-of-way become urbanized, the pipeline would be operated at the appropriate class level. Changes in class location of the pipeline right-of-way would necessitate a reduction in maximum operating pressure or alternative construction measures to upgrade the line pipe to meet those class location requirements as set out in the CSA Standard Z184.

#### Indian Lands

Q & M testified it had studied topographic map sheets and contacted the Department of Indian and Northern Affairs in order to determine the potential impact of the proposed pipeline on Indian lands. The Applicant concluded from its investigations that the route would not cross any Indian Reservations.

#### Mining

Q & M stated that the proposed pipeline would pass through several areas of active and possible future mining. The Bathurst and Sussex areas in New Brunswick contain rich mineral deposits, indicating that the expansion of present mining activity could be anticipated. In Nova Scotia, extensive coal mines in the vicinity of Stellarton along the Glace Bay lateral caused the route to be relocated to the south. Q & M indicated that areas of mining activities which could endanger the pipeline would be avoided where possible. Q & M further stated that a plan, profile and book of reference for the pipeline would be filed with the appropriate Registrar of Deeds, so that the location of the pipeline would be known to persons carrying out title searches. Q & M stated that during final design, modified local procedures would be prepared with special reference to sensitive mining areas. The Applicant testified that this information would be filed with the Board prior to, or with the filing of the plans, profiles and books of reference.

Q & M stated that it had not obtained detailed information on the scheduling of future expansion of mining activities but that this information would be submitted to the Board when available and would be taken into consideration in final route location.

Q & M stated that a detailed search of land titles along the pipeline corridor had not yet been conducted; consequently mining claims had not been located. Q & M indicated that the location of any claims would be determined during final design and that information would be filed with the Board at that time. The Applicant stated that consideration would be given to the need for minor route locations as required to avoid mining claims.

Q & M stated that it had not yet entered into any working agreements, considerations or undertakings with any mining company. Detailed negotiations would be conducted at the time of final route location. Q & M stated that it would file information on any such agreements with the Board at that time.

The Applicant stated that although the proposed pipeline route would avoid an existing open pit gypsum mine at East Milford near the Nova Scotia mainline, it would still cross the property of the mining company. It was further stated that the gypsum company had plans to expand the operation in the direction of the pipeline route, but that Q & M did not have information on the extent of this planned expansion. Q & M stated that it would accommodate any expansion of the mining operation during final design by making minor adjustments to the alignment as necessary, and that all relevant information on these adjustments would be filed with the Board.

Q & M stated that it would negotiate for the use of borrow material with the landowners involved.

#### Water Supply

Q & M identified the municipal watersheds which would be affected by the proposed pipeline as well as the known private wells. The remainder of the private water supply sources would be identified before the design of the line was completed. The location of water supply areas would be included on the line lists so that field personnel would be fully aware of the need for caution.

#### 6.2.4.2 Notification of Affected Authorities and Requisite Approvals General

Q & M stated that it was Company policy to accommodate concerns expressed by affected communities and governments as much as possible during the design of the pipeline. The Applicant stated that prior to the hearing, it had consulted with a number of federal, provincial, and municipal agencies responsible for environmental quality, and urban and regional planning. The project was explained to each agency and discussed with regard to the specific concerns of the agency. Q & M stated that it would identify the standards and requirements which would apply to the proposed pipeline and develop plans to meet those requirements.

#### Federal Authorizations and Legislation

Q & M stated that federal government agencies contacted included Agriculture Canada, the Canadian Wildlife Service, the Department of Indian and Northern Affairs, Environment Canada, Parks Canada, the Ministry of Public Works, the Ministry of State for Urban Affairs and the Ministry of Transport.

Q & M testified that it had contacted the Ministry of Transport to obtain requisite approvals for the crossing of navigable waters pursuant to section 76 of the National Energy Board Act, and that it had obtained a list of all the navigable waters which would be crossed by the pipeline.

Q & M testified that it had not contacted the Canadian Transport Commission regarding the proposed railway crossings under the Commission's jurisdiction. No companies had been contacted directly by Q & M to obtain approvals with the exception of the Canadian National Railway in regard to the Strait of Canso crossing. Q & M testified that there had been some preliminary general discussion of the project with companies, and that it would seek authorization for the crossings following certification.

Q & M stated that the proposed pipeline route was in proximity to the Canadian Forces Base, Gagetown, near Saint John, New Brunswick, as well as Department of National Defence property north of Newcastle.



Q & M testified that the pipeline would not interfere with the activities of the armed forces in those areas nor would those activities pose any threat to pipeline safety.

Q & M stated that the Ministry of Transport might plan to extend the Moncton airport in the future, but that Q & M had concluded that the pipeline would not interfere with airport expansion because of the buffer provided by existing urban development between the proposed route and the airport. Q & M testified that it had not contacted the Ministry of Transport to confirm this conclusion.

#### Provincial Authorizations and Legislation

Q & M testified that it had not identified all of the provincial government agencies from whom authorizations would have to be sought but that it would begin to define these requirements following the hearing. The Applicant confirmed that it would respect the law of the provinces in which the pipeline would be built and cooperate with the provincial agencies to satisfy their concerns to the extent feasible. Q & M stated that it had contacted certain provincial agencies for preliminary consultations. In Quebec these agencies included: Ministère de l'Agriculture, Ministère du Tourisme, de la Chasse et de la Pêche, Ministère de l'Energie, Ministère de l'Industrie et du Commerce, Ministère des Affaires Municipales, Ministère des Affaires Culturelles à Québec, Ministère des Transports, Ministère des Terres et des Forêts, Service de Protection de l'Environnement du Québec, and Hydro-Québec.

Q & M contacted the following agencies of the Province of New Brunswick: Department of Commerce and Development, New Brunswick Electric Power Commission, Environment New Brunswick, Department of Agriculture, Department of Fisheries, Historical Resources Administration, Department of Municipal Affairs, Department of Tourism, and the Department of Transportation.

The following agencies of the Province of Nova Scotia were also contacted: Department of Agriculture, Department of the Environment, Department of Highways, Department of Lands and Forests, Department of Mines, Department of Municipal Affairs, Nova Scotia Power Commission, Maritime Resource Management Service, and the Department of Development.



### Municipal Authorizations and By-Laws

Q & M confirmed that it would follow the procedures set out in its application for the notification of municipal authorities. Q & M stated that upon certification, it would distribute a brochure describing the project to all concerned municipal authorities, along with maps showing the preliminary route location, and a copy of the proposed construction schedule. Municipal authorities would be asked to present any concerns in writing and these would be taken into consideration in the final alignment. Once the routing and the construction schedule were completed, this information would be provided to the municipalities as well as details of the construction procedure. Any subsequent changes in routing or scheduling would also be forwarded to the municipalities. Immediately prior to the start of construction in each municipality the appropriate officers would be notified and told how they could contact the Q & M representative for consultation during the construction process. Each authority would be notified when construction in its area of concern was completed. Q & M further stated that timely application would be made for all municipal permits, licences and authorizations which would be required for the construction and operation of the pipeline. The Applicant filed with the Board a list of the municipal authorities which had been contacted in Quebec, New Brunswick and Nova Scotia prior to the hearing.

Q & M testified that, should the pipeline interfere with municipal drainage systems in the future, its policy would be to reimburse any extra costs incurred because of the location of the pipeline.

#### 6.2.4.3 Land Requirements

##### Permanent Rights-of-Way

Q & M stated that the right-of-way widths, whether mainline, lateral, or sub-lateral, would be determined by pipe diameter size. Right-of-way widths of 30.48 m for pipeline diameter of 1 066.8 mm to 508.0 mm, 22.86 m for pipeline diameter of 406.4 mm to 304.8 mm, and 18.288 m for pipeline diameter of 254.0 mm to 101.6 mm would be required.

The Applicant gave evidence that its policy would be to secure an easement for a practical working width rather than to obtain additional working space at a later date where required, and that it would not restrict the surface use of that right-of-way for agricultural purposes.

#### Temporary Rights-of-Way

Q & M indicated that the right-of-way widths as currently proposed would provide sufficient work space for construction activities over the greater part of the pipeline route. The Applicant stated that during final design an analysis would be made of the selected route to determine specific locations where additional working space would be required, as well as the necessary widths. This information would be filed with the Board.

Q & M stated that additional work space would be required for river crossings, storage of snow removed from the right of way, hills or wet areas where shofly roads are required, storage or stockpile sites and camp sites.

#### Joint Rights-of-Way

The Applicant gave evidence that the proposed pipeline routing was based generally on parallel or contiguous construction rather than on sharing fully or partially the rights-of-way of others, with the possible exception of areas of special crops or congested areas where a common right-of-way would be more desirable. This situation would arise where the Glace Bay Lateral in Nova Scotia would cross the Strait of Canso between the mainland and Cape Breton Island. Q & M testified that the pipeline would be located on the causeway between the hydro towers and the railway, but did not specify its relationship with existing rights-of-way. Q & M stated that from the centre line of the railway there would be a minimum distance of 3.048 m to the centre line of the proposed pipeline.

The Applicant indicated that it had contacted Hydro-Québec, Nova Scotia Power and New Brunswick Power with regard to joint use of their rights-of-way. The Applicant testified that a set of conditions for joint right-of-way use had been received from Hydro-Québec but that

no agreement had been reached. Q & M did confirm, however, subject to the above conditions, that Hydro-Québec would be willing to share its right-of-way, and stated that the construction schedule would allow time for completion of the negotiations where necessary.

Q & M stated that the New Brunswick Power and Nova Scotia Power had indicated that they would have no objection in principle to joint use of their rights-of-way by Q & M, provided that conditions similar to those required by Hydro-Québec were met. Q & M stated that detailed conditions had not yet been submitted.

Q & M submitted a tabulation listing the kilometre posts and distances for which the proposed pipeline would parallel existing or proposed power lines where voltages exceed 69 kV.

Q & M testified that it had contacted the Department of Transport of the Province of Quebec with regard to the use of highway rights-of-way for pipeline construction. The Applicant stated that it had not received a response containing specific terms and conditions for pipeline construction. Q & M testified that use of highway rights-of-way could be advantageous and would be given full consideration.

Q & M agreed to file, on completion of final design, a tabulation of any joint and contiguous use of rights-of-way if required by the Board.

#### Fee Lands

Q & M stated that it would require four compressor stations for its export case and two for its non-export case. The Applicant stated that based on a preliminary evaluation, it did not anticipate any difficulty in locating sites for compressor and meter stations, and acquiring land in fee simple. Q & M testified that the exact location of such sites would not be identified until final design.

#### 6.2.4.4 Land Acquisition

##### Landowner Notifications and Documentations

Q & M indicated it had begun a community information program and testified that a detailed procedure for notifying landowners would be finalized upon certification. Q & M testified that these procedures



would be made available to the Board prior to its filing of plans, profiles and books of reference.

Q & M had set out preliminary notification procedures to ensure that contact would be made with the landowner and/or tenant prior to the first entry on the land and prior to each subsequent entry. During the initial contact, the landowner would be given a description of the project. The implications for his property would be discussed along with the landowner's rights under expropriation procedures. The Applicant's acquisition policy would be defined, and any special requests or unusual conditions would be recorded on a contact report. Following surveying, the landowner would be informed of the precise location of the proposed right-of-way, and would be advised of the construction schedule. Any special requests made by the landowner would be reviewed and resolved to the satisfaction of both parties.

Q & M confirmed in its testimony that the above procedures would form part of a "landowners' handbook" and would be utilized in the entire construction program.

The Applicant gave evidence that landowners in the areas affected by the proposed pipeline had not been notified of the application prior to the hearing because, in the judgement of the Company, it was premature to raise either hopes or fears until final alignment was decided and the individuals affected were identified.

Q & M stated that property lists would be prepared for each section of the pipeline route as the alignment was finalized. Once legal ownership was determined, the Applicant would negotiate easements.

#### Easement Documents

Q & M testified that the easement agreement to be used for this project would be similar to that presently used by its parent company, AGTL. The Applicant gave evidence that it would obtain multiple pipeline rights to provide for future construction of loops.

The easement agreement would include a clause requiring Q&M to pay the landowner the difference in value between what was originally paid for the right-of-way and the current market value of the right-of-way at the time of loop construction.



The Applicant agreed to file with the Board a copy of the final easement document.

#### Expropriations

The Applicant stated that in those cases where it was not possible to negotiate easements, either the line would be relocated or rights-of-way would be expropriated.

The Applicant indicated that although it had not had individual landowner discussions, it had had information sessions with groups of landowners to discuss the project in general terms. Q & M gave evidence that during these discussions many concerns were raised by people with very little knowledge of the implications of an easement across a property and by people who might have had an unfortunate expropriation experience. Q & M stated that it had been the experience of AGTL that expropriation did not best serve the interests of either the builder of the pipeline or the landowner, and the necessity for recourse to expropriation had been extremely low. The Applicant concluded from its past experience and from the general discussions with landowners, that expropriation would not be a major problem.

#### Further Hearings

Q & M testified that it had taken into account the possibility of further hearings with respect to various landowner concerns and that, in its amended application, it had revised the project schedule delaying the start of the project by one year.

The Applicant further testified that the proposed construction schedule could accommodate rerouting of the proposed pipeline required as a result of further hearings.

#### Line Lists

The Applicant stated that it would prepare line lists for the proposed project prior to construction. These lists would include specific concerns of individual landowners, as well as directives for resolving site-specific matters, such as geotechnical or environmental concerns, and names and addresses of individuals to be contacted prior to construction. The Applicant stated that the line lists would form part of the contract between itself and each contractor.

Q & M testified that line lists would be filed with the Board on submission of the plans, profiles and books of reference for approval and would be updated as the project continued.

#### 6.2.4.5 Salt Cavern Storage

##### Right-of-Way Requirements

The Applicant stated that preliminary design would require approximately 30.35 hectares for 6 caverns at one site. Q & M would also require a safety zone of approximately 0.8 km around the perimeter of the cavern area in order to guard against interference from mining or other activities. The total surface area requirement would be about 404.69 hectares. Q & M stated that a right-of-way would also be required for a fresh water pipeline from the proposed water intake near Apohaqui on the Kennebecasis River, to Smith Creek, a distance of about 14.3 km; and for a brine disposal pipeline from Smith Creek to the Bay of Fundy at Fownes Head, a distance of about 47 km. Q & M testified that it had not yet acquired the right-of-way and property for the storage site or pipelines, and that the necessary municipal and provincial permits had not yet been identified. Consultations with landowners would be required.

##### Land Use

Q & M agreed to provide the Board, prior to construction, with a detailed map of the area showing the clearing requirements, location of proposed facilities, extent of the buffer zone, and the nearest residences.

#### 6.2.4.6 Post Construction Activities

##### Clean-Up and Compensation

On completion of clean-up, each landowner and/or tenant would be requested to accompany the clean-up inspector to inspect the right-of-way before the contractor left the area. Each land occupant, on completion of inspection, would be requested to acknowledge that clean-up had been satisfactorily completed.

##### Settlement

Q & M stated that its compensation policy would ensure that a person who had been adversely affected by construction of the project would be compensated in a just and equitable manner and that during the

operational phase he would not be disadvantaged as a result of any action by the Company. The Applicant indicated that damages would be settled as soon as practicable after the clean-up.

#### Progress Reports on Clean-Up and Damage Settlements

Q & M undertook to file with the Board progress reports on the clean-up of the right-of-way. The Applicant further undertook to file, if so required by the Board, reports on damage settlements reached as well as information on properties where settlements had not been reached, including reasons for the inability to reach a settlement.

#### As Builts Drawings

Q & M confirmed that it was aware of the Board's policy requiring the filing of as-constructed drawings. These drawings would show the location of the pipeline in relation to the right-of-way limits, ground profile and the elevation of the line pipe at every crossing of a highway, railway or navigable water, as well as 'actual cover' over the portion of pipeline every 60 m along straight tangents and reasonable levels, every 8 m in side bends and every 3 m in over-bends and sag bends.

#### 6.2.4.7 Views of Intervenors

New Brunswick expressed a number of right-of-way related concerns arising from the proposed pipeline construction. The Province was primarily concerned that its staff and the residents affected by the pipeline in New Brunswick should have the right to review and comment upon the detailed design plans which would be finalized by Q & M following certification. The Province proposed that supplementary public hearings be held in communities along the right-of-way to give an opportunity to landowners, municipalities, and provincial government agencies to express their further concerns related to the proposed design and mitigative measures that should be carried out. The Province recommended that information on the proposed design and mitigative measures be available to the government and public at various locations along the proposed route prior to the local hearings. The Province also expressed concern with the Applicant's landowner and municipal



notification procedures but, indicated during the hearings that it was satisfied with the procedures outlined in Q & M's deficiency response.

New Brunswick identified several of its Acts that could be applicable to certain aspects of the project, such as the brine and fresh water pipelines associated with salt-cavern storage, and requested that the Board direct the Applicant to meet the requirements of this legislation.

The Province proposed that the pipeline be routed within existing energy corridors wherever possible and noted that the St. Stephen and Saint John laterals could possibly be realigned in some areas to meet this goal.

#### 6.2.4.8 Views of the Board

The Board accepts Q & M's statements that the majority of the proposed route would avoid urban areas and that where urban areas are unavoidable, mitigative measures would be taken to minimize disruption.

The Applicant satisfied the Board that the proposed route would not cross any Indian Reserves.

The Board recognizes the Applicant's statement that the proposed pipeline would pass through areas of active and possible future mining activities including borrow resources. If a certificate is to be issued to Q & M, the Board would require, under section 35 of the Act, that Q & M indicate on the plans, profiles, and books of reference, filed pursuant to section 29, the existence of all active and potential mining areas, as well as mining claims along the proposed route of the pipeline which could affect the right-of-way.

Q & M satisfied the Board that necessary arrangements had been or would be made with all federal, provincial and municipal government authorities regarding its project.

The Board accepts Q & M's undertaking to reimburse any extra costs should the pipeline interfere with municipal drainage systems in the future.

The planned right-of-way widths, submitted by Q & M, are acceptable to the Board.



The Board notes the Applicant's statement that, as a policy, joint use rights-of-way were not considered. The Board would require Q & M, as a condition of any certificate, to provide further information should joint use rights-of-way be considered.

The Board accepts Q & M's statement that it could obtain all lands required for compressor and meter station sites.

While the Board is satisfied with the procedures established by Q & M for landowner notifications and land acquisition, the Board notes that landowners had not been notified of this application prior to the hearing.

The Board notes that Q & M would negotiate for multiple line rights in acquiring right-of-way.

The Board notes the statement that Q & M would not expect to have to make widespread use of expropriation. The Board would require the Applicant, if a certificate were granted to Q & M, to file with the Board concurrent with the filing of plans, profiles and books of reference, a listing of all properties subject to expropriation procedures.

The Board accepts Q & M's undertaking to file line lists with the Board.

The Board accepts Q & M's undertakings to clean up and restore the lands through which the pipeline would be constructed and to file reports on clean-up progress and the status of damage settlements, if required.

The Board accepts the Applicant's undertaking to file as-built drawings.

The Board recognizes the possible need to conduct further local hearings and has stated in Procedural Order No. PO-1-GH-4-79 dated 7 May, 1979, paragraph 6, that such hearings would deal with specific landowner concerns and would be held prior to the approval of plans, profiles and books of reference if so required.

### 6.2.5 Environmental Impact

#### 6.2.5.1. Environmental Considerations in Selecting the Route

Prior to determining its proposed route, Q & M examined seven alternatives in New Brunswick and two in Nova Scotia. During this route selection process, all national and provincial parks and recreational lands were considered major constraints and were avoided in the route selection. Furthermore, Q & M attempted to avoid existing or potential built-up areas unless such locations had to be crossed to reach a gas delivery point. In general, encroachment upon special crops was avoided where possible.

Routes through the central portion of the province of New Brunswick were eliminated to avoid the rugged terrain and the environmentally sensitive Miramichi River. Route changes were also made in New Brunswick to minimize interference with reforestation programs and planned future forestry industry activity.

Although it would not share a common right-of-way, the proposed pipeline would parallel existing transportation and utility corridors. This is especially evident in Nova Scotia where the proposed route almost entirely parallels existing rights-of-way.

Site selection for Q & M's compressor stations was based primarily on engineering considerations, but, in part, on evidence of areas with potential environmental conflict.

#### 6.2.5.2 Environmental Impact and Mitigative Measures

##### Applicant's Policy

Q & M stated that it recognized its obligation to design, construct and operate the pipeline to comply with all reasonable environmental standards and that it would make a thorough and conscientious effort to achieve an environmentally acceptable project.

In support of its application, Q & M presented an environmental impact statement containing recommendations for site-specific mitigative measures. Q & M endorsed and accepted its environmental consultant's recommendations as they were presented in the environmental impact statement. If, due to minor route relocations during final design, certain of the recommendations were no longer valid or relevant, the

Company testified that alternate mitigative measures would be established. In addition to specific mitigative measures, Q & M's environmental consultants made numerous recommendations for further site-specific studies. Q & M's representative testified that all these investigations would be undertaken and that the final precise central line location would be confirmed only after their completion.

Furthermore, Q & M would consider all information and concerns received by persons and organizations, and these considerations would be affected in the final design, construction and operation of its pipeline.

#### Terrain

Q & M's policy on mitigating terrain damage was that landowners and land use should not suffer as a result of pipeline construction. The terrain considerations associated with Q & M's pipeline construction can be divided into those which are general and would apply to the entire route and those which are regional and would apply only to sections of the route.

The four general terrain considerations are: pre-construction ground preparation activities, soil problems, maintenance of slope stability and terrain restoration procedures.

Included in pre-construction ground preparation activities are: clearing, grubbing and grading. Q & M stated that prior to construction, the Company would clear the entire width of the right-of-way unless otherwise stipulated by the landowner. The clearing would generally be done by standard construction equipment. Grubbing and grading would be done in all areas where summer construction is proposed but would not necessarily be done in areas of winter construction. Grubbing and grading would be minimized at river and stream banks to maintain slope stability.

Problems associated with soils include erosion and compaction. The soils situated along the right-of-way that are considered to be susceptible to erosion and compaction were identified by the Applicant in its Environmental Atlas. It was Q & M's opinion that the problem of erosion of soils could best be minimized by controlling the waterflow



along the right-of-way. This would be done by constructing channels across the right-of-way in a herringbone pattern. Where required, Q & M would also employ such techniques as leaving the root structure in place during the grading operation and constructing temporary berms.

Compaction of soils would have the most severe impact when crossing agricultural lands and a discussion of the Company's mitigative measures are contained in the Agricultural Land Use section of this report.

Methods Q & M would employ to maintain slope stability would be to leave the vegetation near watercourses or lakes until just prior to actual construction of the crossing. Any disturbed sites would be restored by revegetation and mulching and would be protected from disturbance resulting from animal movement.

Q & M testified that its terrain clean-up and restoration program would commence as soon as practical after the completion of construction activities. The Company stated that it would use appropriate clean-up methods to ensure that the lands through which the pipeline passed would be left in a stabilized condition which would not interfere with existing land use. Q & M's clean-up program would include the removal and proper disposal of all refuse, boulders, brush, stumps, skids and waste construction material. All combustible waste material would be burned in a proper manner and other materials buried on the right-of-way in areas such as abandoned borrow pits or at other locations approved by those authorities having jurisdiction. All stockpile and storage areas would be restored to a clean, orderly condition, and all surplus construction material would be collected and returned to permanent maintenance facilities or to other designated storage areas.

As part of its land restoration program, Q & M intended to revegetate the entire right-of-way in non-agricultural areas where there had been ground disturbance and at locations susceptible to erosion. Mixes of native and agronomic grass species would be used for seeding purposes. They would be applied by helicopters except in areas such as near powerlines, where other mechanical techniques for spreading seed and fertilizer would be employed. At sites where seeding alone might be



inadequate, other techniques such as the planting of shrubs, protective matting, rip-rap or mulching would be used.

Terrain restoration procedures would be to slope or terrace and contour side hill cuts and to grade and contour disturbed areas to eliminate any unnatural or hazardous relief.

The terrain considerations which would apply to only certain regions along the proposed route are the areas of Champlain Sea marine clays, wetlands and marshes, and crossing the Meguma Fold Belt of Nova Scotia.

Construction through marine clays could cause considerable environmental damage in terms of slope failure and slumping. These clays underlie the pipeline route from Lévis-Lauzon to the vicinity of Montmagny. Prior to construction, Q & M would be conducting soil investigations to determine the extent of potential landslide and slope failure hazards and would develop site-specific designs for these potentially unstable slopes. The Company outlined certain general precautionary measures it would use when constructing on sensitive clay slopes. On these unstable slopes, ditching would be wider, slope angles would be decreased and pipe and equipment would be kept well away from trench sides. To maintain slope stability at river crossings in sensitive clays, Q & M would control soil moisture, maintain a fairly flat slope and provide special drainage requirements.

A concern associated with wetland construction is the risk of severe terrain and habitat modification associated with excessive drainage. To prevent water migration from wetlands, the consultants recommended the use of ditch plugs. Prior to construction, Q & M would carry out field studies in order to design adequate mitigative measures for construction across wetlands. Based on the data available, Q & M would construct the pipeline across major wetland areas during the winter when the ground was frozen. If there were a significant thaw during construction, the spread would be shut down.

In the Meguma Fold Belt of the Atlantic Uplands, Q & M estimated that between 25 and 30 miles of slate bedrock would be encountered parts of which, when exposed to moisture, could produce acid

runoff. To reduce adverse effects on adjacent waterbodies, Q & M would limit the extent to which the material was exposed to the atmosphere, particularly during wet conditions.

Q & M intended to conduct subsurface geotechnical investigations at potentially unstable slopes, at certain river crossings and at any other areas where there might be geotechnical difficulties.

Prior to construction, Q & M would also undertake geotechnical evaluations on wetlands and in areas of slate bedrock.

#### Borrow Resources

In the application, Q & M stated that the development of borrow pits for select backfill would be subject to proper vegetation disposal, topsoil conservation and reclamation/revegetation practices.

Q & M's witness testified that preliminary estimates of the amount of gravel or borrow required for the project have been made but that it had not determined the precise locations from which it would obtain its borrow material. The Company expects that to meet its needs it would have to develop some new borrow pits.

If, during final design, it were apparent that a new pit had to be developed, Q & M would undertake an assessment of potential new borrow sites along the route. Should the study indicate that the borrow pit would have an adverse effect on the environment, Q & M would relocate the site.

With respect to the possibility of obtaining sand and gravel from river and streambeds, Q & M's environmental consultant testified that the Company would not be removing gravel from any active streambed. Gravel might be removed from dry side channels, but any gravel removal from such a source would be done only after consultation with provincial authorities.

#### Archaeological and Historical Resources

Historical and archaeological sites are common in all three provinces traversed by Q & M's proposed line. Q & M's policy regarding these sites was to avoid them; however, at this time a large number of sites are unknown and should be considered as potential constraints.

Q & M had not yet undertaken a site-specific archaeological evaluation, but a detailed survey would be carried out by a professional archaeologist prior to construction. The survey would be designed after consultation with the respective provinces and would take their requirements into consideration. If, during the initial centre-line survey a site were discovered, Q & M testified that the line would be moved.

In areas identified as having a high archaeological value, a qualified archaeologist would be on-site during the ditching operations. Should such a site be uncovered during construction, inspectors would be required to protect the resource. The area would be marked and construction personnel warned about the importance of the discovery and the existing legislation regarding the penalty for destroying potential historical material.

An interpretation would be sought on the significance of a find and an on-site decision would be made by a qualified person as to whether the site warranted salvaging. Any decision to halt construction to permit salvaging work would be made by Q & M on the recommendation of an archaeologist.

Q & M testified that it would collaborate with provincial authorities to document any archaeological or historical find.

#### Agricultural Land Use

Agriculture is an extremely important land use along Q & M's proposed route and is particularly significant in the various lowland areas of Quebec, New Brunswick and Nova Scotia.

Q & M stated its policy was to ensure that all agricultural lands it would cross were brought back to pre-construction productivity.

Q & M's environmental consultants recommended that construction take place during the winter to minimize conflicts with ongoing farming activities and to provide for soil protection. An examination of Q & M's construction schedule shows that this recommendation would be followed on only certain of the spreads.

Q & M stated in its application that, in general and where feasible, its proposed route would avoid important agricultural basins,



would follow existing rights-of-way, would avoid agricultural areas with extensive drainage systems, would parallel property lines, and would avoid crops incompatible with pipeline construction (such as fruit trees, sugar bushes, potato seed farms and berry farms).

The Company testified that where its proposed route would traverse agricultural lands, the topsoils were thick (average between 30 cm and 46 cm) and that thin topsoils were generally not encountered in agricultural areas. The Company further testified that while it had no practical experience constructing pipelines in areas where thin topsoils (less than 15 cm) were used for agricultural purposes, it could restore these topsoils back to their original productivity.

The most important soil protection method proposed by Q & M would be to strip the topsoil from the ditchline and store it on the side of the trench. Subsoil would then be excavated and placed in a separate pile alongside the topsoil. While there would be no minimum distance specified between the piles of topsoil and subsoil, Q & M intended to place the piles in such a way as to avoid mixing. Any erosion of the piles as a result of rainfall would be reduced by trenching to contain the runoff. During the backfill operation, Q & M would prevent the piled subsoil from mixing with the in-situ topsoil by controlling the depth of its backfill blade and bucket during the backfill operation. If, despite precautions, there was inadvertent mixing of topsoil and subsoil, soil fertility would be restored by applying fertilizer. In cases where, for such reasons as excessive acidity, the subsoil was potentially damaging to the topsoil, the subsoil would be removed and a select backfill used.

Topsoil removal and stockpiling would be under the control of the ditching crew foreman. An inspector would be responsible for ensuring that the procedures determined by agricultural experts during the detailed design, were followed. These procedures and plans would be in the actual construction specifications and would be formulated by Q & M after consultation with provincial specialists. While Q & M would not have a soils expert on-site, one would be available in the field, if required, to do an occasional spot-check or to monitor final effects.

Another concern on agricultural lands is excessive soil compaction and erosion. To prevent compaction, Q & M testified that, in



general, it would avoid construction on agricultural soils during extreme wet conditions. If a heavy rainfall occurred during construction, Q & M testified that an on-site assessment would be made on how to deal with the situation. Q & M's main method of restoring compacted soil would be deep-tilling and the occasional planting of some strong rooted crops such as légumes. Compacted areas would be monitored after construction.

As part of its restoration program, Q & M would make certain that stones and rocks present as a result of construction activities were removed during the clean-up operation. Any revegetation program would be carried out after consultation with the respective landowners.

When constructing through agricultural lands, Q & M anticipated encountering a variety of drainage systems including drainage ditches and subsurface drainage systems. Where construction encountered a drainage ditch, Q & M intended to maintain a reasonable depth of cover under the ditch so as not to interfere with its operation.

In the case of subsurface tile drainage systems, the location of cut tiles would be identified during the initial ditching operation and marked with a flag by the ditching crew and the location recorded by the engineering crew. In areas underlain by tile drainage, Q & M would generally maintain a 1.5 m depth of cover.

Q & M testified that its policy is to restore all drainage systems (including the older types) damaged during pipeline construction. Q & M proposed to follow its consultant's recommendations concerning the construction across fields with drainage tiles and would have a tile specialist present at the construction site. All repairs would be inspected by the Company and, if requested, would be available for inspection by the landowner as well. In addition, Q & M would verify that no other tiles were crushed or misshapen by movement of heavy equipment along the right-of-way. In the event that post-construction flooding occurred in fields containing restored tile drainage systems, it would be Q & M's policy to make further repairs.

On agricultural lands, Q & M would design and carry out a revegetation program in consultation with the landowner. Q & M had not

finalized its revegetation program for agricultural land, however, this would be done prior to construction.

The Company testified that it would monitor its revegetation program to gauge its success and to determine if additional work needed to be done.

#### Forests and Woodlots

The precise areas of the proposed right-of-way which would traverse forested areas were identified in the Company's Environmental Atlas. In the Maritimes, the percentage is approximately 80 percent of the total route.

The negative impacts to forests as a result of pipeline construction would be the loss of timber, the loss or alteration of wildlife habitat, the restricted access of heavy equipment over the right-of-way because of possible damage to the pipe and the long-term loss of potential revenue.

In locating its route through wooded zones, Q & M attempted to avoid small public forests in more rural developments. However, very large tracts of forest were not considered as constraints on route location as, according to the Company, these tracts were generally unavoidable.

Q & M's policy was to avoid mature hardwood forests, especially those containing syrup-producing maples. Where such avoidance was impossible, Q & M would carefully select a route in such a way as to avoid or minimize cutting down valuable trees.

As general measures to protect forests, their resources and surrounding habitats, Q & M's consultants have made the following recommendations. Clearing activities should be limited in forest areas with particular attention to high quality tree stands, and all merchantable timber should be properly salvaged and disposed of in accordance with provincial forestry regulations and landowners' requests.

Non-merchantable timber should be chipped and spread on the right-of-way or disposed of in a manner satisfactory to the landowner and/or tenant. Non-merchantable timber should not be buried on the right-of-way and the accumulation of debris should be avoided.

No refuse or timber should be disposed of within 61 m of rivers, streams or lakes. A further method of protecting the waterways would be to leave buffer strips along the waterways to prevent siltation. All injured trees should be treated or removed as they could become susceptible to diseases which could then spread to other trees. To protect trees alongside the right-of-way, they should be left free of earth and debris.

Because the soils in forested areas, especially those in the Maritimes, are thin and of poor quality, clearing could pose a serious erosion problem due to the lack of solidly rooted vegetation cover. Such erosion could have a long-term residual effect resulting in the gradual loss of timber adjacent to the right-of-way. Q & M was confident, however, that by using such techniques as water diversion structures and a good revegetation program, the erosion of the thin forest soil could be controlled. On-site evaluations would be required to determine the appropriate mitigative measures.

The width of Q & M's right-of-way through forested lands had not been determined but would be a site-specific issue. However, for a considerable portion of the pipeline route through forests, Q & M would be paralleling existing rights-of-way. Whether the Company would consistently share a common right-of-way or construct a separate one had also not been determined. The Company stated that if there were no potential adverse effects upon the ungulate populations, one large open space might be preferred over a series of narrow parallel rights-of-way. However, a series of narrower rights-of-way might be preferable in areas populated by moose as these animals are generally reluctant to cross a large open space.

When rock blasting through forested lands, Q & M stated that it would not remove the shot rock, but would windrow it over the ditchline.

A threat posed by pipeline construction through forests is the danger of fire, particularly when brush from the clearing operation is being burnt. During high risk periods, such burning might be prohibited by provincial authorities.



To minimize the risk of forest fire throughout the construction phase, Q & M would ensure that field supervisory staff received fire-fighting training and that forest fire patrols were mounted. Fire-fighting equipment would be on-site and stored in a special shed. Q & M would participate in any contingency plans set up by provincial and/or municipal forestry officials to be implemented in the event of a fire.

#### Other Land Uses

The line, as presently routed, would cross through the Waverly Game Reserve in Nova Scotia. According to Q & M, the officials of this Reserve favoured a route through the Reserve because it would open up some of the dense spruce forest which would benefit the wildlife. However, no evaluation had been made of the effects of the right-of-way on the wildlife in the sanctuary. The Company intended to use fencing and locked gates at both ends of the easement to restrict access into the Game Reserve.

#### Wildlife Resources

Q & M did not undertake an in-depth ecological study on wildlife, but considered primarily the large ungulates (namely deer and moose) which populate the proposed route and which are economically important for sport-hunting. The critical factor concerning these two species was the protection of their winter feeding areas known as yards where large numbers congregate. The majority of deer yards have been located by the provincial lands and forests specialists and the results mapped in Q & M's Environmental Atlas. Moose yards which tend to shift from year to year were not as easily mapped and would have to be located just prior to construction.

Q & M's policy was to avoid deer and moose yards if possible. If a large yard were unavoidable, such as the yard adjacent to Lac Pohénégamook, Q & M's intention would be to cross these yards during the summer or early winter. Construction during late winter would seriously affect the deer and moose populations because of the scarcity of food and the fact that animal movement would be restricted by deep snow.



In keeping with this general policy to avoid deer and moose yards, the Company would be doing further site-specific studies to attempt to realign its proposed route around yards. If, after further studies certain yards were still to be crossed, Q & M's consultants recommended that a proper set of guidelines be developed for crossing yards, as well as a specific scheme based on each yard's characteristics.

Another concern raised by Q & M's environmental consultant was the fact that rights-of-way could create access paths for hunters, snowmobilers, and dogs, into deer and moose yards. The Company testified that it was not its policy to put up barriers; however, this might be done on a site-specific basis for control of access and for visual enhancement.

Q & M intended to monitor deer and moose yards through air reconnaissance and site inspections, but final details of the monitoring programs had not been established.

Q & M's proposed line would be passing through areas of suitable avifauna habitat. Of special concern are the staging and feeding zones used during fall and spring migration, and the nesting and brooding areas. According to the environmental consultants, the greatest potential negative impact on the population was not the presence of the pipeline, but rather the actual construction activities. Large-scale movement, traffic and associated noise could seriously disrupt birds and hamper their staging, nesting and feeding activities. The period of highest vulnerability is between 15 May and 15 August, when there are heavy concentrations of bird populations in migration.

Q & M had not yet prepared a management plan indicating waterfowl area through which its line would pass, but testified that this would be done during final design and after consultation with respective provincial and federal authorities. However, the line, as proposed, would be crossing the Amherst-Tantram Marsh area which is a major waterfowl habitat. Under cross-examination, Q & M stated that it would be constructing in the winter through this marsh in order to avoid

problems with the waterfowl population. Q & M also testified that the Canadian Wildlife Service had informed the Company that the proposed pipeline alignment would not interfere with its study plans in the Amherst-Tantramar Marsh.

Q & M's line would be passing through areas, for example, on Cape Breton Island, which support eagle and osprey populations which are considered to be "endangered species".

Where the proposed line would pass close to eagle or osprey nests, the environmental consultant recommended that construction take place in late summer in order to protect the birds. Q & M had not established a minimum distance it would maintain between eagle and osprey nests and its proposed line.

#### Fish Resources

Two types of fish communities that could be adversely affected by pipeline construction and operation were distinguished by the environmental consultants. The first was warm-water fish whose natural characteristics had been previously altered by human activity inhabiting waterways. The second type was cold-water fish inhabiting waterways relatively unaffected by human activity. This second type would be most susceptible to pipeline construction activity within the stream channel. The negative impacts to be avoided involved the smothering of eggs by excessive sedimentation, the loss of spawning grounds, the prevention of fish migration, the loss of nurseries in areas where shoreline vegetation is removed and the contamination of water by accidental spills of toxic elements. The majority of Q & M's proposed route through New Brunswick and Nova Scotia would cross streams whose main fish populations are of the cold water type and of significant economic and recreational importance.

Q & M's consultants recommended that to avoid serious negative impacts on the fish populations, stream crossings should be avoided between 1 September and 30 May for fall spawners, and between 1 April and 30 June for spring spawners or at any other time when the use of water courses by fish is high. The consultants also recommended that passages

for migrating fish be maintained. Q & M testified that it intended to maintain a depth of 0.3 m of water at stream crossing sites to ensure fish passage. The environmental consultant recommended that further site-specific investigations be done to identify the fish resources and to determine mitigative measures. Q & M testified that it would be conducting detailed site-specific stream evaluations during final design and would notify its contractors of any specific concerns and any appropriate mitigative measures to be implemented. Specific spawning areas would be located during these evaluations.

During cross-examination Q & M stated that mitigation of fisheries concerns was an integral component in their construction schedule and that their schedule provided sufficient flexibility to protect the resources. According to Q & M the proposed timing of construction was the best means of protecting the fish. Nevertheless, Q & M's schedule indicated that it would be crossing certain trout and salmon supporting streams during the winter and that this could damage eggs and negatively affect fish over-wintering areas. To explain this discrepancy, Q & M testified that, where construction would occur during a non-recommended period (such as on the Newcastle Lateral) the schedule had been chosen from a total impact point of view. In the case of the Newcastle Lateral, much of the route was through muskeg and winter construction was preferable on this type of terrain.

#### Toxic Elements

Under cross-examination Q & M stated that in its design and construction procedures it minimized the use of toxic elements. The two main categories of toxic elements which would pose a serious environmental risk are fuel substances and pesticides (insecticides and herbicides).

Q & M testified that it would not use pesticides if there were a possibility of contaminating other resources in the vicinity. With respect to fuel substances, fuel oil to be used for its equipment would be moved by tank truck from major storage depots to the equipment in the



fields. Servicing of equipment would generally be done on the right-of-way or in service yards. The Company would develop procedures for the proper containment and disposal of drained toxic substances.

In the event of a spill of a toxic substance on topsoil, Q & M stated that the contaminated topsoil would be removed and that if the spill were large, the soil would be replaced. In some instances it would be necessary to burn off the toxic substance.

#### Water Resources

The construction of the proposed pipeline facilities could give rise to potential impacts upon water resources as a result of the route chosen, the trenching at river crossings, the hydrostatic testing and the dissolving of salt with fresh water to create caverns for gas storage. Furthermore, the disposal of pollutants from camp and construction sites and of brine from salt-cavern development could affect nearby water bodies. These potential impacts are discussed in the following paragraphs.

In its route selection, Q & M stated that it had avoided all water supply sources (municipal watersheds and wells) whenever possible. Q & M identified the watersheds and known wells along its route and testified that any water supply areas requiring special precautions would be identified prior to construction. Certain municipal watersheds to be crossed by the proposed route (such as those at Port Hawkesbury and Stewiacke) would be avoided in final route alignment.

Where a watershed could not be avoided, the Company would take special precautions of ensuring that all equipment, fuel storage and service areas were located outside the area, and of prohibiting the use of pesticides and herbicides in these areas. Such precautions would apply, for instance, in the watershed area for Amherst. In this case the route could not be realigned because of the presence of a tidal marsh and of salt-extraction activities.

Numerous rivers, streams and waterbodies would be crossed by Q & M along its route with nine of the larger crossings being Lac Pohénégamook in Quebec; the Salmon, Tobique, Jemseg, Cambridge,



Petitcodiac and Saint John Rivers in New Brunswick; and the Strait of Canso and Beaver Narrows in Nova Scotia. The majority of these crossings would be constructed as part of a regular spread, but because of the complexity and size of the Strait of Canso crossing, a separate crew and/or contractor would be needed. Q & M provided the location and schedule for six of the nine major or intermediate crossings but no detailed designs were submitted.

The potential negative impacts associated with water crossings are the excessive downstream sedimentation which can threaten the fish population, the possible alteration of the course of the water flow, the alteration or destruction of the surrounding aquatic habitat, the possible release of toxic elements during trenching, and the possible permanent damage to the river or streambed.

The Company would attempt to avoid crossings in seasons when the potential for siltation could be severe. To prevent excessive downstream sedimentation when crossing smaller waterways, the operations would be conducted from one side of the stream and waterflow would be restrained by such means as straw bales. The Company testified that detailed site-specific studies would be undertaken during final design in order to develop specific mitigative measures for avoiding excessive sedimentation.

When trenching at crossings, Q & M intended to follow recommendations presented by its environmental consultants. These recommendations included: having all materials assembled on shore prior to trenching, limiting trenching time, minimizing the time between trenching and pipe installation, maintaining a hard plug in the land trench until immediately prior to construction, and using sediment traps or sandbags to prevent excessive bed erosion. In most cases the backfill used would be the excavated material.

To provide for traffic of construction equipment across stream or small river beds, the Company would, in most cases, construct temporary bridging and use culverts to maintain waterflow and fish passage. Fording would be kept to a minimum and would only be attempted

where there were rocks or boulders. On very large streams, barges, or ferries would be used. The Company stated that traffic would be prohibited from moving along stream banks and drainageways.

In general, Q & M intended to follow all of its consultant's recommendations regarding crossings, providing subsequent data such as minor route relocation did not change these recommendations.

With respect to hydrostatic testing, environmental concerns centred on the procedure for obtaining and disposing of the test water.

Q & M stated that obtaining water for hydrostatic testing should pose no problems as there were numerous possible sources along the proposed pipeline route. However, the specific water courses to be used would be identified only during final design. The Company's policy would be to avoid taking water from sensitive watercourses and to restrict the drawdown to ten percent of the existing stream flow. At test sites, Q & M would follow the provincial guidelines on water intake structures. When disposing of test water, the Company would comply with the requirements of the authorities having jurisdiction.

Q & M's witness testified that the Company would use methanol-water solutions in only two specific instances. The two instances would be initially to use methanol washes to make certain the section of pipeline was clean, and finally to remove all water from the pipeline after the test. The methanol would be run through the line between two "pigs", placed in a container and then disposed of.

In order to construct salt-caverns for gas storage at Smith Creek, New Brunswick, Q & M proposed to withdraw water from the Kennebecasis River at Apohaqui and pipe it to Sussex, 14.3 km to the east. For the export case  $3.6 \text{ m}^3$  per minute of fresh water would be pumped over an eight-year period, and for the non-export case,  $7.2 \text{ m}^3$  per minute would be pumped over a four to five-year period.

The Kennebecasis River primarily supports salmon and brook trout. There is one known rearing area for salmon parr which is situated

in the immediate vicinity of the proposed water intake. The two critical periods are summer, when parr are feeding and adults are migrating upstream, and winter, when eggs are developing. Excessive reduction in flow during the winter could cause destruction of spawning beds by freezing or oxygen depletion. Prime salmon spawning and rearing habitat are located upstream from the water intake at Apohaqui and could be rendered inaccessible to salmon if flow reduction is sufficient to inhibit spawning migrations. Also, there is the possibility that the marshes, which provide breeding habitat for waterfowl, could be affected by reduction of water.

Q & M's policy would be to limit water withdrawal from the Kennebecasis River to a maximum 10 percent of the low flow. This criterion of 10 percent was determined from detailed work done on 11 streams in the U.S.A. Under average flow conditions Q & M did not anticipate any problem but stated that caution would have to be exercised during extremely dry years.

Q & M acknowledged that further studies were necessary to identify the potential trouble spots that would most likely be affected by the water withdrawal and to determine the biological importance of these areas.

During cross-examination Q & M testified that an alternate water source situated 10 miles further west at Belleisle Bay could be used. This site is under tidal influence and has adequate water available. Q & M testified that the use of salt water versus fresh water would make very minimal difference in the cavern washing process.

To dispose of the brine generated by the salt-cavern washing, a pipeline would be built 48 km long between Sussex and the Bay of Fundy. The outfall of the pipe would extend 655 m into the Bay and would be situated in 18 m of water.

A description of the marine environment was provided; however, the Applicant acknowledged that very few studies have been carried out in the vicinity of the brine outflow, and biologically, the area east of Saint John to the head of the Bay of Fundy was not well known. Q & M in

its environmental report reviewed the literature on the criterion for excess salinity leading to mortality and suggested that, for long-term exposure, an excess salinity of 0.5 mg/l above ambient should be used as a conservation criterion. No predictive model of the dispersion of brine into the Bay of Fundy was carried out. Comparison studies carried out in the Gulf of Mexico show that 0.85 ha would experience a 0.5 mg/l or greater salinity above ambient conditions. Q & M stated that no definite opinion could be expressed as to the impact of the proposed brine outfall on the benthonic community prior to the completion of a full investigation.

Further studies were recommended by the consultant involving detailed depth profiles, current patterns and velocities in the entire water column, water quality and a complete survey of all marine species in the Bay. Furthermore, laboratory studies are required for determining lethal salinity levels for the principal marine species present. The consultants recommended the above factors should then be analysed in relation to the brine plume model to determine the long-term impacts on the marine communities.

With respect to the disposal of pollutants, Q & M's environmental consultant recognized that solid and liquid waste from the construction camps might be a source of water pollution. The Company stated that all camp water would be diverted and disposed of in accordance with the requirements of the appropriate government agencies.

#### Noise

The compressor station in Quebec would be powered by electric and turbine units with a total station horsepower of 9,750. In New Brunswick, the stations would house reciprocating units with total station horsepower of 11,000. The compressor station for the gas storage facility, which would be located near Smith Creek in New Brunswick, would initially consist of a 550 horsepower integral reciprocating compressor with three 1,320 horsepower units to be installed in 1986/87.



In order to mitigate the impact of noise emissions on adjacent residents, Q & M attempted to locate its stations away from built-up areas and from neighbouring houses. Q & M's objective was to maintain a minimum distance of 800 m between its stations and residences.

The Company stated that the noise level at the station fence line would not exceed 50 dBA and that its compressor stations had been designed to provide for noise reduction to that level. Although Q & M was confident that its operating noise levels would not cause a disturbance to neighbouring residences, should Q & M receive complaints, it would employ further noise suppression techniques, such as additional insulation, to mitigate the noise. In addition, Q & M was prepared to incorporate further noise suppression techniques in its station design if so ordered. Examples of such techniques would be an increase in the amount of insulation, the secondary muffling of intake or exhaust gases and design changes to place above-ground pipe underground.

#### 6.2.5.3 Environmental Inspection, Supervision and Monitoring

##### Environmental Inspection and Supervision

Q & M stated that it intended to provide an orientation program for workers on the project which would include an explanation of the terms and conditions contained in any certificate granted and other applicable regulations insofar as they relate to construction, as well as an explanation of environmental procedures.

Q & M's witness testified that it would develop an environmental orientation program prior to commencement of construction.

In order to ensure that the construction and operation of its pipeline would be carried out in an environmentally acceptable manner, the Applicant would prepare procedures manuals containing the standard practices for environmental protection common to gas pipeline projects as well as specific procedures relating to unique environmental concerns encountered. These procedures manuals would be an integral part of the contractor's documents and, consequently, part of the construction specifications.

The responsibility for enforcing Q & M's environmental procedures would rest with a quality assurance team, which would be composed of Q & M's pipeline inspectors and specialists, including environmentalists. The chief of this team would report directly to Q & M headquarters and not to the contractor.

Q & M testified that, should a member of the quality assurance team encounter an environmental problem or unacceptable procedure during construction, he would first discuss it with the contractor. If the results of these discussions were unsatisfactory, headquarters would be contacted. In the majority of cases, headquarters' personnel would make a decision on how to handle the matter. Q & M stated, however, that it would grant some emergency powers to its chief of quality assurance so that, under very grave circumstances, he would have the authority to shut down construction.

In addition to the quality assurance team, Q & M would also have a pipeline inspection team in the field. The supervisory inspectors of these teams would have had previous experience on a gas pipeline project. Q & M intended to initiate an inspection training program with the assistance of its parent company, AGTL, prior to construction and that its pipeline inspection team would participate in the program. However, the content and scope of the program had not been finalized.

Environmental Monitoring

Q & M intended to implement an environmental monitoring program but the details of this long-term environmental monitoring program were not finalized.

#### 6.2.5.4 Views of Intervenors

The evidence of UPA as described in an earlier section of this report applies to the Q & M pipeline between Lévis/Lauzon and the Quebec/New Brunswick border.

A general concern of New Brunswick was that Q & M's environmental report did not provide detailed site-specific information on impacts of construction nor on the methods proposed to minimize or mitigate these impacts. It noted that Q & M's report made repeated calls for more

in-depth studies relating to environmental impacts and mitigative measures. It was the opinion of the Province that the environmental report raised more questions than it answered and that reviewers could only agree that further detailed studies were required before any definitive response was possible. As a result, if a certificate were to be issued to Q & M, local hearings would be necessary.

New Brunswick recommended that the pipeline should be routed within existing energy corridors whenever possible and further testified that electrical transmission corridors would be suitable. In some cases only minor realignment would be necessary. Other cases, however, would require major realignment.

New Brunswick was concerned that the routes proposed for the pipeline project would pass through all of the prime agricultural areas of New Brunswick. Provincial witnesses testified that it would be possible to construct a pipeline in agricultural areas of New Brunswick providing proper precautions were taken for the preservation and restoration of soils. The Province recommended that construction on prime agricultural lands be carried out in winter to avoid compaction, but stated that detailed measures would depend upon particular site-specific problems.

New Brunswick felt that the quality of the historical and archaeological sites would be seriously reduced, if not obliterated, if appropriate studies and mitigative measures were not undertaken prior to construction.

New Brunswick was further concerned about the potential impact of the proposed pipeline routes on fresh-water quality of its rivers and streams, with particular regard to spawning grounds and sensitive water-supply basins. The Province testified that they had identified several sensitive water supply locations such as Turtle Creek, Nigadoo River, Hailes Brook, and Dennis Stream. The Province recommended that the Board ensure that the Applicant identified all fisheries near the proposed pipeline route, and minimized the number of stream crossings.

New Brunswick witnesses testified that they would require more detailed information to evaluate the environmental impact of withdrawing fresh water from the Kennebecasis River in order to create the salt caverns which Q & M proposed.

#### 6.2.5.5 Views of the Board

The Board notes Q & M's statement that it recognizes its obligation to design, construct and operate its pipeline in such a manner as to comply with all reasonable environmental standards. Q & M also stated that it would make a thorough and conscientious effort to have its project achieve a high level of environmental compatibility.

The Board has assessed all of Q & M's evidence for its environmental acceptability. The Board is not convinced that Q & M is sufficiently cognizant of the nature of the environmental concerns it would encounter, nor does it appear to the Board that the Company has sufficiently planned and thought out the appropriate mitigative measures necessary to protect the environment through which its pipeline would pass.

The Board agrees with New Brunswick that detailed site-specific information on impacts of construction, and the methods to be used to minimize these impacts have not been provided by Q & M.

Furthermore, the Board concludes that the Applicant's commitment that its pipeline would achieve a high level of compatibility is premature, in view of the amount of environmental information which the Company acknowledged is still to be gathered, analyzed and incorporated into its design and construction plans. The Board notes and agrees with Q & M's environmental consultant's recommendation that many in-depth studies should be undertaken to adequately assess the environmental concerns and to prepare appropriate mitigative measures.

The Board concludes that Q & M has not satisfied the Board that this line would be constructed in, "...an environmentally acceptable manner", nor that it would achieve, as the Company states, "...a high level of environmental compatibility." Furthermore, the Board concludes that the Applicant has only partly fulfilled Part VI of the Schedule to



the National Energy Board Rules of Practice and Procedure, which requires the Applicant to submit a qualitative, and where feasible, quantitative assessment of the probable impact on the environment, on land resource uses, and on human health and wellbeing. In this regard Q & M has not submitted a description of the plans, facilities, procedures and methods to avoid, prevent or mitigate the probable environmental effects.

It is apparent that Q & M would have to undertake considerable additional work in order to assure the Board that the environment would be adequately protected during the construction and operation of the proposed pipeline. In the Board's opinion, the following major environmental concerns were not adequately addressed by Q & M, and in any further examination of the environmental impact of the construction and operation of its proposed pipeline, the Applicant should include, but not limit itself to, providing the Board with the following information with regard to the major environmental concerns.

- (a) A feasibility study on the more extensive use of existing multifunctional corridors when establishing a route; a listing of the route adjustments necessary to avoid as many sugar bush lots and special crop areas as possible; a detailed listing of the environmental constraints that remain unavoidable and the site-specific mitigative measures to protect against unnecessary environmental damage.
- (b) A policy for work stoppage on marine clays during wet periods, as well as a listing of the site-specific measures planned to prevent slope failure at unstable embankments, and construction procedures for protecting the environment at water crossings.
- (c) The specific measures proposed to prevent soil erosion and compaction and the measures to counteract long-term negative impact, should erosion or compaction occur as a result of construction the specific details of a terrain restoration program for all the various terrain regions that would be crossed.
- (d) With respect to the scarce and fragile agricultural soils of the Maritimes, an analysis involving mitigative measures that would

be employed during winter and summer construction on agricultural lands.

- (e) The methods to be used to restore surface drainage systems.
- (f) The identification and investigation of fish resources in the watercourses the proposed pipeline would cross; the location of spawning grounds; an outline of the concerns with reference to the timing of construction activities; an assessment of the potential impact of pipeline construction on these fish resources; and the development of appropriate site-specific mitigative measures for use by the Company's contractors.
- (g) A management plan indicating the areas of suitable avifauna habitat through which the pipeline would pass indicating the plans and procedures which would be implemented to minimize the impact on these areas.
- (h) Specific plans and procedures to minimize any adverse environmental impact on endangered raptor populations in the vicinity of the pipeline route.
- (i) An analysis of the impact on the environment of using alternative sources of water, including water from the Bay of Fundy, to develop the salt caverns at Sussex; and a complete environmental study on the impact of discharging large volumes of brine into the Bay of Fundy.
- (j) The specific methods and policies Q & M would use to oblige its contractors to abide by the Applicant's environmental undertakings.

Thus, prior to considering the issuance of any certificate to Q & M, the Board would require Q & M to address all those areas outlined in Part VI of the Schedule to the Board's Rules of Practice and Procedure with special reference to the information listed above.

Figure 6-1

# PROPOSED PROJECT TRANSCANADA



# PROPOSED PROJECT Q & M

KILOMETRES  
0 20 40 60 80 100



QUEBEC

NEW  
BRUNSWICK

P. E. I.

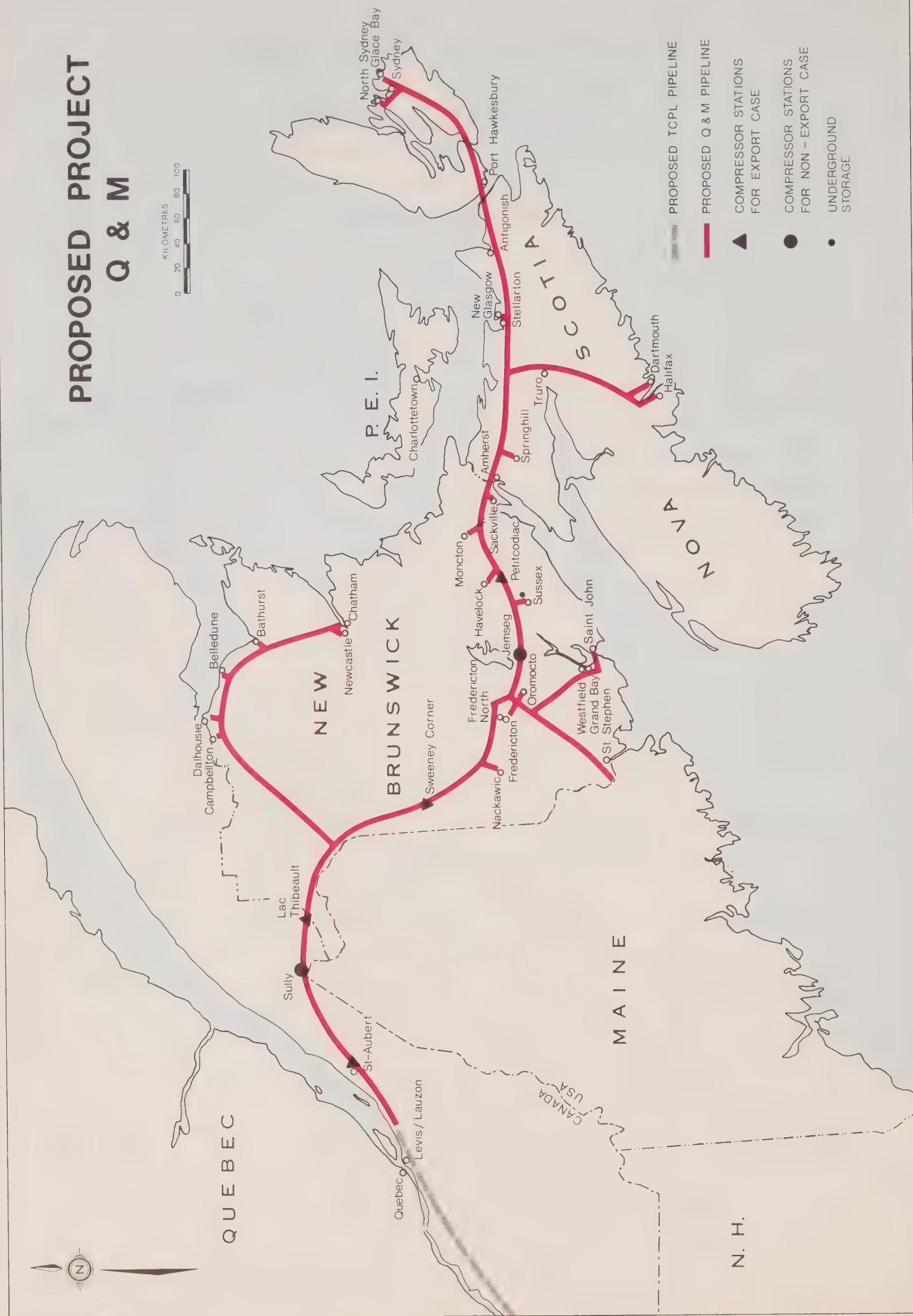
SCOTIA

NOVA

MAINE

N. H.

- PROPOSED TCPL PIPELINE
- PROPOSED Q & M PIPELINE
- COMPRESSOR STATIONS FOR EXPORT CASE
- COMPRESSOR STATIONS FOR NON-EXPORT CASE
- UNDERGROUND STORAGE





THROUGHPUT REQUIREMENTS  
TRANSCANADA'S SYSTEM

Using the Board's 1979 requirements forecast as set out in Appendix C of the Licence Phase Report, the Board has estimated the future throughput requirements for the Western and Central Sections of the TransCanada system. The following assumptions were made in the analysis.

- (1) No diversion of the Consolidated or ProGas volumes to the prebuilt facilities of the Foothills system will occur during the term of these licences;
- (2) Existing export licences for gas carried by TransCanada will expire as they reach their term, without extension;
- (3) Canadian requirements for gas in markets already served by TransCanada are those set out in Appendix C of the Licence Phase Report;
- (4) The potential additional sales of natural gas in existing market areas and sales in expansion markets are those set out in Table C-17 of Appendix C of the Licence Phase Report and Chapter 4 of this Report, respectively;
- (5) The existing capacity in the Great Lakes system is fully utilized before the volumes in the TransCanada Central Section are increased, and no expansion of the Great Lakes system occurs; and
- (6) New TransCanada facilities will be constructed as required to carry the projected volumes in each year (i.e., the capacity in any year is the greater of that year's throughput requirements or the largest previous annual throughput requirement).

The Board's forecast was derived from the following tables:

Table 1 reflects total Canadian requirements East of Alberta, currently authorized exports and additional sales in Manitoba and Ontario.

Table 2 shows the new exports which would be transported through the TransCanada system.

Table 3 shows the Base Case throughput requirements for the Western Section of the TransCanada system.

Table 4 shows the Base Case throughput requirements for the Great Lakes system and the Central Section of the TransCanada system.

Tables 5 and 6 are similar to Tables 3 and 4 but include projected sales in expansion markets in Quebec.

Tables 7 and 8 are similar to Tables -3 and -4 but include projected sales in expansion markets in Quebec and the Maritimes.

Table 1  
SUMMARY OF REQUIREMENTS AND FLOW ADJUSTMENTS

Volumes in  $10^9 \text{m}^3$

EAST OF ALBERTA REQUIREMENTS

Year	1 Demand East of Alberta	2 Domestic Expansion	3 Current To Midwestern	4 Exports to Others	5 Total Exports (3+4)	6 Total Requirements (1+2+5)
1980	27.21	0.00	2.60	4.53	7.13	34.34
1981	28.02	0.15	1.59	4.48	6.07	34.25
1982	28.47	0.31	1.59	4.48	6.07	34.85
1983	28.72	0.56	1.59	4.48	6.07	35.35
1984	29.12	0.82	1.59	4.48	6.07	36.01
1985	29.65	0.97	1.59	4.48	6.07	36.70
1986	30.02	1.08	1.59	4.29	5.88	36.97
1987	30.51	1.13	1.59	4.29	5.88	37.51
1988	30.75	1.18	1.59	4.32	5.91	37.83
1989	31.32	1.23	1.59	3.98	5.57	38.12
1990	31.87	1.28	0.06	3.70	3.76	36.91
1991	32.61	1.33	0.00	1.50	1.50	35.44
1992	33.34	1.35	0.00	0.22	0.22	34.92
1993	34.21	1.41	0.00	0.22	0.22	35.84
1994	35.14	1.43	0.00	0.22	0.22	36.80
1995	36.08	1.48	0.00	0.17	0.17	37.73
1996	36.86	1.53	0.00	0.00	0.00	38.39
1997	37.90	1.58	0.00	0.00	0.00	39.49
1998	39.02	1.61	0.00	0.00	0.00	40.63
1999	40.30	1.66	0.00	0.00	0.00	41.96
2000	41.67	1.71	0.00	0.00	0.00	43.38

Column 1 Board's Requirements forecast as set out in Appendix C of the Licence Phase Report.

Column 2 Board estimate of additional sales in Ontario and Manitoba.

Column 3 is taken from Appendix 4-B, the sum of Licences GL-1, GL-18 and GL-39, NEB 1979 Gas Report.

Column 5 is taken from Appendix 4-A, Page 1 of 11, COLUMN 9 less "TCPL Makeup" from Appendix 4-B, NEB 1979 Gas Report

Note: Volumes from the above appendices are converted to cubic metres by dividing by TransCanada's GHV of  $37.86 \text{ MJ/m}^3$ .

Table 2

SUMMARY OF LICENCE PHASE EXPORTS

Volumes in  $10^9 \text{m}^3$

EXPORTS BY

	1	2	3	4	5	6
						Total
<u>Year</u>	<u>Consolidated</u>	<u>Niagara</u>	<u>ProGas</u>	<u>Sulpetro</u>	<u>TransCanada</u>	<u>Requirements</u> <u>(1+2+3+4+5)</u>
1980	0.35	0.10	0.52	0.72	1.13	2.82
1981	2.07	0.09	3.10	0.61	2.10	7.97
1982	2.07	0.09	3.10	0.51	2.10	7.87
1983	2.07	0.09	3.10	0.00	2.10	7.36
1984	1.98	0.09	2.97	0.00	2.10	7.14
1985	1.46	0.09	2.20	0.00	1.36	5.11
1986	0.95	0.13	1.42	0.00	0.00	2.50
1987	0.43	0.06	0.65	0.00	0.00	1.14
1988	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.00	0.00	0.00	0.00	0.00	0.00
1992	0.00	0.00	0.00	0.00	0.00	0.00
1993	0.00	0.00	0.00	0.00	0.00	0.00
1994	0.00	0.00	0.00	0.00	0.00	0.00
1995	0.00	0.00	0.00	0.00	0.00	0.00
1996	0.00	0.00	0.00	0.00	0.00	0.00
1997	0.00	0.00	0.00	0.00	0.00	0.00
1998	0.00	0.00	0.00	0.00	0.00	0.00
1999	0.00	0.00	0.00	0.00	0.00	0.00
2000	0.00	0.00	0.00	0.00	0.00	0.00



Table 3

TRANSCANADA PIPELINES  
THROUGHPUT REQUIREMENTS FOR THE WESTERN SECTION

Base Case								
Volumes in 10 <sup>9</sup> m <sup>3</sup>								
	1	2	3	4	5	6	7	8
	Total East of Alberta Requirements	New Exports	Many Islands	Production East of Alberta	Total Trans- portation	Total Requirements (1+2-3-4+5)	Fuel	Western Section Deliveries (6-7)
Year								
1980	34.34	2.81	0.55	1.50	1.20	36.29	1.81	34.48
1981	34.25	7.97	0.57	1.48	1.31	41.48	2.07	39.41
1982	34.85	7.86	0.66	1.42	1.31	41.95	2.10	39.85
1983	35.35	7.35	0.70	1.39	1.31	41.92	2.10	39.82
1984	36.01	7.14	0.79	1.36	1.31	42.31	2.12	40.19
1985	36.70	5.11	0.74	1.28	1.31	41.09	2.05	39.04
1986	36.97	2.49	0.66	1.17	1.31	38.94	1.95	36.99
1987	37.51	1.13	0.58	1.25	1.31	38.12	1.91	36.21
1988	37.83	0.00	0.52	1.34	1.31	37.29	1.86	35.42
1989	38.12	0.00	0.46	1.17	1.31	37.80	1.89	35.91
1990	36.91	0.00	0.41	1.06	1.31	36.75	1.84	34.91
1991	35.44	0.00	0.36	0.97	1.31	35.42	1.77	33.65
1992	34.92	0.00	0.33	0.86	1.31	35.04	1.75	33.29
1993	35.84	0.00	0.29	0.81	0.84	35.58	1.78	33.80
1994	36.80	0.00	0.26	0.75	0.84	36.62	1.83	34.79
1995	37.73	0.00	0.23	0.64	0.84	37.69	1.88	35.81
1996	38.39	0.00	0.21	0.58	0.84	38.43	1.92	36.51
1997	39.49	0.00	0.19	0.56	0.84	39.58	1.98	37.60
1998	40.63	0.00	0.17	0.53	0.84	40.77	2.04	38.73
1999	41.96	0.00	0.15	0.50	0.84	42.14	2.11	40.03
2000	43.38	0.00	0.13	0.47	0.84	43.61	2.18	41.43

Column 1 is taken from Column 6, Table 1

Column 2 is taken from Column 6, Table 2

Fuel = 0.05 x Column 6

Table 4  
TRANSCANADA PIPELINES  
THROUGHPUT REQUIREMENTS FOR THE CENTRAL SECTION  
AND GREAT LAKES PIPELINES

Base Case

Volumes in 10<sup>9</sup>m<sup>3</sup>

Year	Flows from Western Section					Great Lakes Flows					12 Central Section (6-11)	
	1	2	3	4	5	6	7	8	9	10		
	Western Section Deliveries	SPC Trans- portation	Current	Exports to Midwestern GL-1 Ext.	Manitoba Sales	Total Sales East of Winnipeg (1-2-3-4-5)	Great Lakes Capacity	Consolidated Re-Export	TCPL Exports	Canadian Deliveries		
1980	34.48	0.84	2.60	1.13	1.86	28.05	13.46	0.36	4.75	8.34	13.46	14.60
1981	39.41	0.84	1.59	2.10	1.91	32.98	13.46	0.47	9.06	3.93	13.46	19.53
1982	39.85	0.84	1.59	2.10	1.93	33.40	13.46	0.47	9.06	3.93	13.46	19.94
1983	39.82	0.84	1.59	2.10	1.96	33.34	13.46	0.47	9.06	3.93	13.46	19.89
1984	40.19	0.84	1.59	2.10	1.99	33.68	13.46	0.47	8.84	4.14	13.46	20.23
1985	39.04	0.84	1.59	1.36	2.03	33.23	13.46	0.47	7.55	5.43	13.46	19.77
1986	36.99	0.84	1.59	0.00	2.06	32.51	13.46	0.47	6.26	6.73	13.46	19.06
1987	36.21	0.84	1.59	0.00	2.10	31.69	13.46	0.47	4.96	8.02	13.46	18.24
1988	35.42	0.84	1.59	0.00	2.12	30.88	13.46	0.47	3.89	9.09	13.46	17.42
1989	35.91	0.84	1.59	0.00	2.17	31.32	13.46	0.47	3.89	9.09	13.46	17.86
1990	34.91	0.84	0.06	0.00	2.21	31.81	13.46	0.47	3.89	9.09	13.46	18.35
1991	33.65	0.84	0.00	0.00	2.26	30.55	13.46	0.47	1.25	9.29	11.02	19.53
1992	33.29	0.84	0.00	0.00	2.31	30.14	13.46	0.47	0.00	9.29	9.77	20.38
1993	33.80	0.84	0.00	0.00	2.37	30.59	13.46	0.00	0.00	9.29	9.29	21.30
1994	34.79	0.84	0.00	0.00	2.44	31.51	13.46	0.00	0.00	9.29	9.29	22.22
1995	35.81	0.84	0.00	0.00	2.51	32.46	13.46	0.00	0.00	9.29	9.29	23.17
1996	36.51	0.84	0.00	0.00	2.57	33.11	13.46	0.00	0.00	9.29	9.29	23.82
1997	37.60	0.84	0.00	0.00	2.64	34.12	13.46	0.00	0.00	9.29	9.29	24.83
1998	38.73	0.84	0.00	0.00	2.72	35.18	13.46	0.00	0.00	9.29	9.29	25.89
1999	40.03	0.84	0.00	0.00	2.80	36.39	13.46	0.00	0.00	9.29	9.29	27.10
2000	41.43	0.84	0.00	0.00	2.90	37.70	13.46	0.00	0.00	9.29	9.29	28.40

Column 1 is taken from Column 8, Table 3

Column 3 is taken from Column 3, Table 1

Table 5

TRANSCANADA PIPELINES  
THROUGHPUT REQUIREMENTS FOR THE WESTERN SECTION

Base Case Plus Expansion to Quebec Only

Year	1	2	3	4	Volumes in 10 <sup>9</sup> m <sup>3</sup>		7	8
	Total East of Alberta Requirements	New Exports	Many Islands	Production East of Alberta	Total Trans- portation	Total Requirements (1+2-3-4+5)	Fuel	Western Section Deliveries (6-7)
1980	34.34	2.81	0.55	1.50	1.20	36.29	1.81	34.48
1981	34.45	7.97	0.57	1.48	1.31	41.68	2.08	39.60
1982	35.36	7.86	0.66	1.42	1.31	42.46	2.12	40.33
1983	36.09	7.35	0.70	1.39	1.31	42.65	2.13	40.52
1984	37.51	7.14	0.79	1.36	1.31	43.80	2.19	41.61
1985	38.63	5.11	0.74	1.28	1.31	43.03	2.15	40.88
1986	39.18	2.49	0.66	1.17	1.31	41.15	2.06	39.09
1987	40.04	1.13	0.58	1.25	1.31	40.64	2.03	38.61
1988	40.73	0.00	0.52	1.34	1.31	40.18	2.01	38.17
1989	41.44	0.00	0.46	1.17	1.31	41.12	2.06	39.07
1990	40.73	0.00	0.41	1.06	1.31	40.58	2.03	38.55
1991	39.51	0.00	0.36	0.97	1.31	39.48	1.97	37.50
1992	39.23	0.00	0.33	0.86	1.31	39.35	1.97	37.38
1993	40.42	0.00	0.29	0.81	0.84	40.16	2.01	38.15
1994	41.67	0.00	0.26	0.75	0.84	41.49	2.07	39.42
1995	42.91	0.00	0.23	0.64	0.84	42.87	2.14	40.73
1996	43.79	0.00	0.21	0.58	0.84	43.83	2.19	41.63
1997	45.10	0.00	0.19	0.56	0.84	45.19	2.26	42.93
1998	46.47	0.00	0.17	0.53	0.84	46.61	2.33	44.28
1999	48.03	0.00	0.15	0.50	0.84	48.22	2.41	45.81
2000	49.71	0.00	0.13	0.47	0.84	49.94	2.50	47.44

Column 1 is taken from Column 6, Table 1 plus Quebec expansion market, Table 4-4

Column 2 is taken from Column 6, Table 2

Fuel = 0.05 x Column 6

Table 6  
TRANSCANADA PIPELINES  
THROUGHPUT REQUIREMENTS FOR THE CENTRAL SECTION  
AND GREAT LAKES PIPELINES  
Base Case Plus Expansion to Quebec Only

Year	Volumes in 10 <sup>9</sup> m <sup>3</sup>											
	Flows From Western Section					Great Lakes Flows					12	
	1	2	3	4	5	6	7	8	9	10		11
	Western Section Deliveries	SPC Trans- portation	Exports to Midwestern Current	Exports to GL-1 Ext.	Manitoba Sales	Total Sales East of Winnipeg (1-2-3-4-5)	Great Lakes Capacity	Consolidated Re-Export	TCPL Exports	Canadian Deliveries	Total Great Lakes (8+9+10)	Central Section (6-11)
1980	34.48	0.84	2.60	1.13	1.86	28.05	13.46	0.36	4.75	8.34	13.46	14.60
1981	39.60	0.84	1.59	2.10	1.91	33.17	13.46	0.47	9.06	3.93	13.46	19.72
1982	40.33	0.84	1.59	2.10	1.93	33.88	13.46	0.47	9.06	3.93	13.46	20.42
1983	40.52	0.84	1.59	2.10	1.96	34.04	13.46	0.47	9.06	3.93	13.46	20.59
1984	41.61	0.84	1.59	2.10	1.99	35.10	13.46	0.47	8.84	4.14	13.46	21.65
1985	40.88	0.84	1.59	1.36	2.03	35.06	13.46	0.47	7.55	5.43	13.46	21.61
1986	39.09	0.84	1.59	0.00	2.06	34.61	13.46	0.47	6.26	6.73	13.46	21.15
1987	38.61	0.84	1.59	0.00	2.10	34.09	13.46	0.47	4.96	8.02	13.46	20.63
1988	38.17	0.84	1.59	0.00	2.12	33.62	13.46	0.47	3.89	9.09	13.46	20.17
1989	39.07	0.84	1.59	0.00	2.17	34.47	13.46	0.47	3.89	9.09	13.46	21.02
1990	38.55	0.84	0.06	0.00	2.21	35.45	13.46	0.47	3.89	9.09	13.46	21.99
1991	37.50	0.84	0.00	0.00	2.26	34.41	13.46	0.47	1.25	9.29	11.02	23.39
1992	37.38	0.84	0.00	0.00	2.31	34.24	13.46	0.47	0.00	9.29	9.77	24.47
1993	38.15	0.84	0.00	0.00	2.37	34.95	13.46	0.00	0.00	9.29	9.29	25.65
1994	39.42	0.84	0.00	0.00	2.44	36.14	13.46	0.00	0.00	9.29	9.29	26.85
1995	40.73	0.84	0.00	0.00	2.51	37.39	13.46	0.00	0.00	9.29	9.29	28.10
1996	41.63	0.84	0.00	0.00	2.57	38.23	13.46	0.00	0.00	9.29	9.29	28.94
1997	42.93	0.84	0.00	0.00	2.64	39.45	13.46	0.00	0.00	9.29	9.29	30.16
1998	44.28	0.84	0.00	0.00	2.72	40.73	13.46	0.00	0.00	9.29	9.29	31.44
1999	45.81	0.84	0.00	0.00	2.80	42.17	13.46	0.00	0.00	9.29	9.29	32.88
2000	47.44	0.84	0.00	0.00	2.90	43.70	13.46	0.00	0.00	9.29	9.29	34.41

Column 1 is taken from Column 8, Table 3  
Column 3 is taken from Column 3, Table 1  
Column 5 is taken from Column 5, Table 2



Table 7

TRANSCANADA PIPELINES  
THROUGHPUT REQUIREMENTS FOR THE WESTERN SECTION

Base Case Plus Expansion to Quebec and Maritimes

Year	Volumes in 10 <sup>9</sup> m <sup>3</sup>							
	1	2	3	4	5	6	7	8
	Total East of Alberta Requirements	New Exports	Many Islands	Production East of Alberta	Total Trans- portation	Total Requirements (1+2-3-4+5)	Fuel	Western Section Deliveries (6-7)
1980	34.34	2.81	0.55	1.50	1.20	36.29	1.81	34.48
1981	34.45	7.97	0.57	1.48	1.31	41.68	2.08	39.60
1982	35.52	7.86	0.66	1.42	1.31	42.61	2.13	40.48
1983	36.98	7.35	0.70	1.39	1.31	43.55	2.18	41.37
1984	38.64	7.14	0.79	1.36	1.31	44.94	2.25	42.69
1985	39.93	5.11	0.74	1.28	1.31	44.33	2.22	42.11
1986	40.30	2.49	0.66	1.17	1.31	42.27	2.11	40.16
1987	41.08	1.13	0.58	1.25	1.31	41.69	2.08	39.60
1988	41.76	0.00	0.52	1.34	1.31	41.21	2.06	39.15
1989	42.51	0.00	0.46	1.17	1.31	42.19	2.11	40.08
1990	41.86	0.00	0.41	1.06	1.31	41.70	2.09	39.62
1991	40.68	0.00	0.36	0.97	1.31	40.65	2.03	38.62
1992	40.47	0.00	0.33	0.86	1.31	40.59	2.03	38.56
1993	41.72	0.00	0.29	0.81	0.84	41.46	2.07	39.39
1994	43.03	0.00	0.26	0.75	0.84	42.85	2.14	40.71
1995	44.34	0.00	0.23	0.64	0.84	44.30	2.22	42.09
1996	45.26	0.00	0.21	0.58	0.84	45.30	2.26	43.03
1997	46.61	0.00	0.19	0.56	0.84	46.70	2.34	44.37
1998	48.04	0.00	0.17	0.53	0.84	48.17	2.41	45.77
1999	49.65	0.00	0.15	0.50	0.84	49.83	2.49	47.34
2000	51.37	0.00	0.13	0.47	0.84	51.60	2.58	49.02

Column 1 is taken from Column 6, Table 1 plus Quebec and Maritimes expansion markets, Tables 4-4 and 4-10.

Column 2 is taken from Column 6, Table 2

Fuel = 0.05 x Column 6

Table 8

TRANSCANADA PIPELINES  
THROUGHPUT REQUIREMENTS FOR THE CENTRAL SECTION  
AND GREAT LAKES PIPELINES

Expansion to Quebec and Maritimes

Year	Volumes in 10 <sup>9</sup> m <sup>3</sup>											
	Flows From Western Section					Great Lakes Flows						
	1	2	3	4	5	6	7	8	9	10	11	12
	Western Section Deliveries	SPC Trans- portation	Current	Exports to Midwestern GL-1 Ext.	Manitoba Sales	Total Sales East of Winnipeg (1-2-3-4-5)	Great Lakes Capacity	Consolidated Re-Export	TCPL Exports	Canadian Deliveries	Total Great Lakes (8+9+10)	Central Section (6-11)
1980	34.48	0.84	2.60	1.13	1.86	28.05	13.46	0.36	4.75	8.34	13.46	14.60
1981	39.60	0.84	1.59	2.10	1.91	33.17	13.46	0.47	9.06	3.93	13.46	19.72
1982	40.48	0.84	1.59	2.10	1.93	34.03	13.46	0.47	9.06	3.93	13.46	20.57
1983	41.37	0.84	1.59	2.10	1.96	34.89	13.46	0.47	9.06	3.93	13.46	21.44
1984	42.69	0.84	1.59	2.10	1.99	36.18	13.46	0.47	8.84	4.14	13.46	22.72
1985	42.11	0.84	1.59	1.36	2.03	36.30	13.46	0.47	7.55	5.43	13.46	22.84
1986	40.16	0.84	1.59	0.00	2.06	35.68	13.46	0.47	6.26	6.73	13.46	22.22
1987	39.60	0.84	1.59	0.00	2.10	35.08	13.46	0.47	4.96	8.02	13.46	21.63
1988	39.15	0.84	1.59	0.00	2.12	34.60	13.46	0.47	3.89	9.09	13.46	21.15
1989	40.08	0.84	1.59	0.00	2.17	35.48	13.46	0.47	3.89	9.09	13.46	22.03
1990	39.62	0.84	0.06	0.00	2.21	36.51	13.46	0.47	3.89	9.09	13.46	23.06
1991	38.62	0.84	0.00	0.00	2.26	35.52	13.46	0.47	1.25	9.29	11.02	24.50
1992	38.56	0.84	0.00	0.00	2.31	35.41	13.46	0.47	0.00	9.29	9.77	25.64
1993	39.39	0.84	0.00	0.00	2.37	36.18	13.46	0.00	0.00	9.29	9.29	26.89
1994	40.71	0.84	0.00	0.00	2.44	37.44	13.46	0.00	0.00	9.29	28.14	26.89
1995	42.09	0.84	0.00	0.00	2.51	38.74	13.46	0.00	0.00	9.29	9.29	29.45
1996	43.03	0.84	0.00	0.00	2.57	39.63	13.46	0.00	0.00	9.29	9.29	30.34
1997	44.37	0.84	0.00	0.00	2.64	40.89	13.46	0.00	0.00	9.29	9.29	31.60
1998	45.77	0.84	0.00	0.00	2.72	42.21	13.46	0.00	0.00	9.29	9.29	32.92
1999	47.34	0.84	0.00	0.00	2.80	43.70	13.46	0.00	0.00	9.29	9.29	34.41
2000	49.02	0.84	0.00	0.00	2.90	45.28	13.46	0.00	0.00	9.29	9.29	35.99

Column 1 is taken from Column 8, Table 7

Column 3 is taken from Column 3, Table 1

Column 5 is taken from Column 5, Table 2

## CHAPTER 7

### FINANCIAL MATTERS AND CONTRACTS

#### 7.1 TransCanada

##### 7.1.1 Contracts

###### 7.1.1.1 Evidence of the Applicant

TransCanada informed the Board that no firm sales contracts with potential distributors were available for filing, however, letters of intent had been sent to Gaz Intercité and Gaz Métropolitain for supply of firm gas on a long-term basis and negotiations were proceeding.

TransCanada proposed that the form of contract be the same as those currently used. Various types of firm as well as peaking, transportation, and interruptible service would be offered. TransCanada further stated that seasonal service or a form thereof might be available to distributors provided storage could be made available.

TransCanada proposed to execute firm contract demand service contracts on a pro forma basis with potential distributors in Quebec. Contracts would be for a period of twenty years and would provide for adjustments to the nominated level of contract demand during the first five years of service.

###### 7.1.1.2 Views of Intervenors

Gaz Inter-Cité indicated that, subject to its being granted franchise authorization, it expected to sign CD contracts allowing for a build-up of volumes over a ten-year period to a level that would match its sales forecast.

Gaz Métropolitain supported TransCanada's proposed form of CD contract, which provides for a five-year build-up of demand levels. Gaz Métropolitain advocated an industrial development rate to aid in the capture of industrial accounts using heavy fuel oil. Gaz Métropolitain opposed TransCanada's proposal to divide the Quebec expansion market into five or six different delivery areas with the expectation that a

distributor would contract for CD volumes for each of the delivery areas. Gaz Métropolitain felt that all markets to be served in Quebec, including the existing franchise area, should be considered as part of one delivery area.

Consumers' contended that sales contracts with the potential distributors in the new market areas should be filed prior to the Board making its decision. These contracts should provide for a build-up of volumes to match the distributors' sales forecasts. Consumers' also stated that potential distributors would not contract until all of the proposed incentive pricing schemes were in place.

Inter-City indicated that unless the appropriate incentive pricing arrangements had been made, the distributor would not sign a sales contract.

#### 7.1.2 Tariff Matters

##### 7.1.2.1 Evidence of the Applicant

###### Pro Forma Tariff

TransCanada filed a pro forma gas tariff for its Canadian markets east of Alberta including the new delivery areas. The pro forma tariff contained the proposed forms for Contract Demand (CD) and Small General Service (SGS) contracts, rate schedules, and the general terms and conditions. TransCanada proposed to extend the existing Eastern Rate Zone to include the new delivery areas, and to offer development rates during the initial years of service in any new delivery area.

###### Proposed Extension of the Eastern Rate Zone and Rate Design

TransCanada stated that its proposal to extend the Eastern Rate Zone implied that the cost of the proposed expanded Eastern Zone would become part of the costs used in the determination of the Alberta border price. With TransCanada's current rate design methodology the inclusion of the cost of the expanded Eastern Zone would result in a higher CD



transportation rate for all zones including the Eastern Zone. Therefore, the imputed Alberta border price would be lower than would be the case if the Eastern Zone were not extended. This results from the present gas pricing regime wherein the Alberta border price is imputed by deducting from the Toronto reference price the Eastern Zone CD transportation rate at 100 percent load factor.

The effect of the proposed extension of the Eastern Zone would be that while the average price of gas at 100 percent load factor in the Eastern Zone would remain unchanged, the price in all other zones would be lower than would be the case if the Eastern Zone were not extended. This is because of the fact that under the current rate design methodology, for a given increase in TransCanada's cost of service, the increase in CD transportation rates in all zones (west of the Eastern Zone) is smaller than the decrease in the Alberta border price. TransCanada suggested that the use of historical rate design methodology leads to this anomalous situation, that is, a reduction in rates upstream of the Eastern Rate Zone when costs of transportation to the Eastern Rate Zone increase. TransCanada proposed that the rates for zones upstream of the Eastern Rate Zone be designed in such a fashion as to avoid any change in zone differentials by reason of expanding the Eastern Rate Zone.

#### Development Rates

The proposed tariff provided limited rights to a buyer to vary its contract demand during the first five contract years. The CD and SGS rate schedules provided for a "Development Period" of 36 months from the date of initial delivery in any new delivery area when a development rate, equal to the average CD Service rate at 100 percent load factor, would apply.

TransCanada stated that the development rate was proposed to help distributors in developing new markets. TransCanada would not incur any revenue deficiency on this account because under the current rate calculation methodology, the development subsidy would be reflected in a lower Alberta border price.

#### 7.1.2.2 Views of Intervenor

CPA supported the proposed extension of pipeline facilities as far as Quebec City. It recommended, however, that a new zone be created to recognize the additional transportation cost, notwithstanding the possibility of some outside subvention to keep the city-gate prices the same. CPA argued that the Applicant's proposal to extend its Eastern Rate Zone to Quebec City disregarded the rate-making principles established by the Board, which recognize the dependence of transportation cost on distance of haul. In respect of the proposed three-year development rate, CPA held the view that this would not encourage distributors to purchase gas at high load factor or to enter into long-term purchase contracts. It suggested that there be some onus on distributors to aggressively market gas as economically as possible.

IPAC recommended that a certificate be issued authorizing extension of the pipeline to Trois-Rivières. In IPAC's view, rolling-in of costs was a common rate-making procedure, and it would not object to rolling the cost of serving the expanded Quebec market into TCPL's system cost of service. The Association would accept the resultant netback at the Alberta border.

IGUA concluded that the increase in the cost of transmission to the Eastern Zone, as a result of the proposed extension, would lower the Alberta border price and this, in turn, would necessitate an upward readjustment of the Toronto reference price. IGUA contended that, in the long run, the cost of the proposed pipeline facilities would be borne by existing customers if the Eastern Rate Zone were extended. IGUA held the view that existing users of natural gas should incur no extra cost as a result of the proposed extension. IGUA recommended that any certificate issued for the extension of facilities in Quebec be conditioned upon adequate government subsidies being provided.

Consumers' opposed the Applicant's proposal to extend its Eastern Rate Zone. Consumers' argued that under the existing rate design methodology, the costs of upstream and downstream facilities would be allocated to all zones across TCPL's system, including the extended Eastern Zone. Because the bulk of these costs would be fixed, this

would increase the demand component of the transportation rate and, to the extent that a distributor's load factor was less than 100 percent, its average cost for gas would increase. Consumers' concluded that the cost of providing gas to downstream markets at the Toronto reference price would be borne not only by the producing segment of the industry but also by upstream customers.

Consumers' contended that the Applicant's proposal to extend its Eastern Rate Zone to many times the length of any other rate zone on its pipeline system violated accepted utility rate-making principles. Consumers' held the view that a new rate zone or zones could and should be created for the new market areas. It suggested that the cost of service to new market areas should be defined precisely and isolated.

Gaz Métropolitain supported the proposed extension of the Eastern Rate Zone as being absolutely essential.

Gaz Métropolitain supported the three-year development rate proposed by TCPL. It agreed that this would permit distributors to be more aggressive in their marketing program in the initial years. It suggested that the availability of the development rate should be extended to all delivery points on the projected pipeline. Gaz Métropolitain also supported the five-year build-up period in CD contracts and suggested that TCPL should consider implementation of an industrial development tariff.

Gaz Inter-Cité recommended that the Eastern Rate Zone should be extended to include the new markets in Quebec and Maritimes. It argued that the consumers in the new market area should have the same right to the benefits of natural gas that other Canadians have enjoyed for several years.

ICG Scotia recommended that the Eastern Rate Zone should be extended to the Atlantic provinces and that the current pricing regime should be in place.

Inter-City Gas recommended the extension of the Eastern Rate Zone. It held the view that the rolled-in cost approach with the proposed extension would have no adverse impact upon other gas purchases in the Eastern Zone and, consequently, would not result in an increase in

price to the consumer. Inter-City saw a possibility of reduction in the unit cost of gas in zones upstream of the Eastern Zone.

Manitoba objected to TransCanada's rate design proposal to maintain certain rate differentials between zones. It argued that the proposal disregarded the principles of cost allocation and cost-based rates established by the Board in previous rate cases. Manitoba recommended the continuation of cost-based rates. Manitoba argued that it would not receive any direct benefit from the pipeline extension and, therefore, it ought not be placed in a position of paying higher rates. Manitoba believed that the weighting of volumes by distance of haul was appropriate for determining transmission costs.

Ontario objected to the Applicant's proposal to extend its Eastern Rate Zone, which, in its view, made a mockery of the zone concept so carefully considered by the Board in the first TCPL rate case. Ontario recommended that a separate zone for the Province of Quebec be established and that all costs of that zone should be identified and allocated to that zone. Also, it suggested that all upstream facilities required to support the proposed pipeline extension should be added to the cost of that zone. If parity of gas prices was seen to be in the national interest, then it could be achieved through subsidies that were identified and understood rather than hidden in the tariffs. Ontario further suggested that the Applicant's proposal to maintain constant zone differentials should be more carefully analyzed.

Québec supported TCPL's proposal to extend its Eastern Rate Zone and objected to the suggestion of creating a new rate zone for the Quebec expansion market. Québec concluded that the high fixed cost allocated to a new zone would result in a significant increase in the price of gas for a distributor in that zone especially on account of the lower load factor in a new market.



### 7.1.3 Financing Plan

#### 7.1.3.1 Evidence of the Applicant

The financing plan presented by TransCanada as summarized below includes the external capital requirements necessary to finance:

- (1) its 50 percent share of the cost of facilities which were applied for by TransCanada and Q & M,
- (2) additions to its pipeline system required to provide for growth of existing markets, and
- (3) the facilities required upstream of Montreal to service the additional markets east of Montreal.

	TRANSCANADA	
	EXTERNAL CAPITAL REQUIREMENTS	
	Export Case	Non-Export Case
	<u>(\$ millions)</u>	<u>(\$ millions)</u>
Long-term Debt		
- Bonds	\$2,056	\$1,850
- Debentures	<u>870</u>	<u>784</u>
	\$2,926	\$2,634
Equity - Common	<u>332</u>	<u>182</u>
	<u>\$3,258</u>	<u>\$2,816</u>

The actual total consolidated capitalization of TransCanada at 31 December 1978 amounted to \$1.64 billion, including take-or-pay obligations as debt for the determination of cost of capital. At that date, the capital structure consisted of 66 percent debt and preferred equity and 34 percent common equity. TransCanada proposed to maintain, on average, a 65 percent debt and preferred equity and a 35 percent common equity ratio.

TransCanada stated that external capital requirements would be raised in Canadian, American, and other foreign markets, depending on the timing, and the cost and availability of funds. TransCanada anticipated that approximately 90 percent of the additional capital requirements would be in the form of debt financing.

TransCanada stated its practice was to use short-term credit in the form of bank loans and commercial paper to initially pay for its construction activities. TransCanada's financial witness testified that the Company currently deals with four major banks, two in Canada and two in the United States, as well as two of the Canadian counterparts of their principal U.S. bankers. TransCanada stated that it would utilize these banks and its sales of commercial paper in the marketplace to raise short-term capital sufficient for its construction requirements. With respect to borrowings associated with pipeline additions, TransCanada expected to pay no more than the prime rate of interest. TransCanada stated that a maintenance fee would also be paid for maintaining a line of credit in the United States in lieu of actually maintaining a certain percentage of that line of credit as funds in its banks, in order to have an open line to the New York financial markets.

TransCanada testified it had lines of credit totalling \$860 million with its four banks, of which \$220-\$225 million had been drawn down.

TransCanada expected that its past procedure of converting short-term debt into long-term commitments (which can be done at any time on the entire line of credit and borrowings) would be continued in the future. Normally, TransCanada informs its banks in writing giving its banks 30-days notice that the Company would like to convert an amount of short-term debt to long-term debt. TransCanada's arrangements with its banks provide that there be no change in interest rate.

Upon conversion to debt securities in the form of first mortgage pipeline bonds and sinking fund debentures, the normal characteristics of TransCanada's presently outstanding bonds and debentures would continue to prevail.

TransCanada stated its debt securities were rated high in the following categories by the Canadian Bond Rating Service:

First Mortgage Pipeline Bonds	A
Sinking Fund Debentures	B++

The maintenance of its very good credit rating was one of the considerations when TransCanada selected its proposed 35 percent common equity ratio.

TransCanada testified that the present ratio was in excess of 35 percent. The Company's objective would be to issue debt to lower the equity ratio and then maintain the equity ratio at approximately this 35 percent level throughout the years of construction and operation.

TransCanada expressed confidence, from its own knowledge of the marketplace and based on its underwriters' advice, that it could raise all of the capital that would be required for this project. The Company concluded that it could fulfill its obligations so long as it was permitted to earn a reasonable return on its investment, and provided it maintained an appropriate credit rating.

TransCanada testified that the additional capital requirements for other construction projects were not incorporated in the financial projections filed in this hearing. However, such projects as Northern Border, Polar Gas, Dow Chemical, and Foothills (Sask.) were given consideration by TransCanada in determining the availability and cost of funds for this project.

With respect to financing of 50 percent of the cost of facilities applied for the TransCanada and Q & M, TransCanada indicated that it expected to issue debt securities to raise the funds necessary to pay for its participation in the joint venture particularly in the earlier years, and stated that it might be necessary to issue equity in later years.

TransCanada stated that it would directly fund its proportionate share of joint venture cash requirements.

A capital structure of 75 percent debt and 25 percent equity was deemed by the joint venturers for purposes of determining the joint venture's cost of service. Cash would simply be transferred between the

venturers and the joint venture. There would be no identification of these funds, in terms of whether or not they were debt or equity as they went into the joint venture. Thus, all of TransCanada's existing shareholders would bear the financial risks associated with the financing of this project.

The amount of the external capital requirements attributable to TransCanada's participation in the joint venture can be summarized as follows:

	Export Case	Non-Export Case
	(\$ millions)	(\$ millions)
Long-term Debt	\$335.2	\$282.4
Equity	<u>111.9</u>	<u>94.1</u>
	<u>\$447.1</u>	<u>\$376.5</u>

TransCanada stated it would raise funds in the same way if there were no joint venture. Its plan for financing these facilities would be exactly the same as that already testified to by its financial witnesses for financing its share of the joint venture.

The amount of the external capital requirements attributable to the facilities applied for by TransCanada can be summarized as follows:

	Export Case	Non-Export Case
	(\$ millions)	(\$ millions)
Long-term Debt	\$295.0	\$269.1
Equity	<u>98.0</u>	<u>89.9</u>
	<u>\$393.0</u>	<u>\$359.0</u>

#### 7.1.3.2 Views of Intervenors

No intervenor commented on the financing plan proposed by TransCanada.

#### 7.1.4 Views of the Board

In regard to sales contracts between TransCanada and potential distributors in Quebec, the Board would normally require that TransCanada file a contract for the sale of gas to the distributor. However, in this



instance, the Board recognizes the difficulties involved in making such filings available. First, the question of franchise right has still to be decided. Hearings are currently underway before the Régie de l'électricité et du gaz in Quebec to decide between applications by Gaz Intercité and Gaz Métropolitain. Until a decision is rendered, TransCanada is unable to conclude contract terms for unfranchised areas. Insofar as sales contracts for areas that are currently franchised are concerned, such as the Boisbriand area, the Board would expect TransCanada to file its sales contracts as soon as possible. The second limiting factor to the execution of the sales contracts is the distributors' stated requirement that prior to signing a firm sales contract, some form of pricing and incentive agreement must be in place. The Board recognizes that the establishment of these incentives requires agreement between parties other than TransCanada and the distributor and that this is not within their control.

It is unlikely, therefore, that signed sales contracts will be available prior to the resolution of the foregoing. However, with the exception of the portion of the pipeline from St-Lazare to Boisbriand, on which a Board decision has previously been rendered, the Board will insist that all sales contracts are in place and on file with the Board before construction commences.

With respect to tariff matters raised at the hearing, the Board made it clear that it had before it for determination two applications for certificates under Part III of the Act and that it would not issue any order with respect to matters relating to tariffs under Part IV of the Act as a result of these proceedings. The Board recognizes that certain pricing and incentive mechanisms will be required to achieve the market demand forecast by TransCanada. The Board finds that the proposal of TransCanada to extend the Eastern Zone to include new delivery areas and to offer development rates in the early years of the project are two means, among others, of assisting in this regard. The full implications of the extension of the Eastern Zone and development rates were not examined in these proceedings, but there will be an opportunity for such an examination to take place at a forthcoming TransCanada rate case.

As to TransCanada's proforma gas tariff, the Board recognizes that approval in principle of this tariff would considerably assist in the financing of the project. As noted above, the Board indicated at the outset of the hearing that it would only consider tariff matters and cost of service information to the extent necessary to assess the economic feasibility of the proposed pipeline. The Board intends to examine the Applicant's proposals on tariff matters in detail at a forthcoming TransCanada rate case.

The Board concludes that the financing plan proposed by TransCanada is feasible. However, any certificate issued to TransCanada would require it to satisfy the Board that appropriate arrangements have been made for financing the additional pipeline, before construction commences.

## 7.2 Q & M

### 7.2.1 Contracts

#### 7.2.1.1 Evidence of the Applicant

Q & M stated that no sales contracts had been signed because no distributors were in place in the proposed market areas. Q & M testified that negotiations were planned with two potential gas distributors, Nova Scotia Power and ICG Scotia Gas. No negotiations had taken place with respect to New Brunswick.

Q & M proposed that the sales contracts would be for a twenty-year term and would provide for contract demand nominations which would be negotiable for the first five years of service. Q & M also proposed a development rate for the first three years of service.

#### 7.2.1.2 Views of Intervenors

ICG Scotia stated it was prepared to enter into long-term supply contracts based upon its forecasts, subject to the proposed pricing incentive schemes being in place and ICG Scotia being awarded the franchise.

Nova Scotia stated that it expected long-term contracts would be signed between the distributor and the supplier to support the pipeline extension.

Nova Scotia Power indicated that if it were awarded the franchise, it would consider signing supply contracts to serve potential market areas in the Province. It would not, however, enter into long-term contracts for the use of gas for its thermal generation requirements, because it expected to eventually use coal for that purpose. Nova Scotia Power also stated that in the event that it was not selected as the gas distributor in Nova Scotia, it would seek permission to buy gas directly from the transporter for use in its thermal plants in the short-term, but in so doing it proposed that the gas used for thermal generation be pooled with the total volumes taken by the distributor in order to minimize the costs of the distribution network.

## 7.2.2 Tariff Matters

### 7.2.2.1 Evidence of the Applicant

#### Q & M and TCPL Joint Venture Tariff

Q & M and TransCanada filed a pro forma gas transportation tariff for the proposed joint venture "Company". The tariff described the Company as the operator of a natural gas pipeline network including storage facilities providing natural gas transportation service. The tariff set forth the rates and the terms and conditions respecting transportation service provided by the Company. The tariff provided for a monthly cost of service formula rate, with a provision for the abatement of the equity return in circumstances where there was an inability to render service. The Company's cost of service would include return, depreciation, operation and maintenance, and other expenses, and income taxes on a normalized basis. The tariff, which would be available to all potential shippers, provided for the determination of a shipper's allocable share of the Company's cost of service.

The tariff provided that the Company would estimate its cost of service for six-month periods beginning the first day of January and July. A shipper would pay the Company a monthly charge based on that shipper's allocable share of the Company's estimated cost of service for

the six-month period plus an adjustment to reflect any differences between the actual and estimated cost of service for the previous six-month period.

TransCanada stated that it would purchase the transportation service provided by the Company. It proposed to include in its accounts the transmission charges paid to the Company as "Transmission by Others".

#### 7.2.2.2 Views of Intervenors

Intervenor

s did not comment on the details of the pro forma gas transportation tariff filed by Q & M and TransCanada.

Q & M supported TransCanada's proposals for an extension of the Eastern Zone and development rates. The views of intervenor

s on these matters can be found in a previous part of this Chapter.

#### 7.2.3 Financing Plan

##### 7.2.3.1 Evidence of the Applicant

Q & M stated that AGTL would finance 50 percent of the cost of the facilities proposed by Q & M and TransCanada through a wholly-owned subsidiary, but it had not been decided whether Q & M would be that wholly-owned subsidiary. Q & M's financial plan and projected sources of funds may be summarized as follows:

	Export Case	Non-Export Case
	(\$ millions)	(\$ millions)
Long-term Debt-Canadian Banks	\$335.2	\$282.4
Equity - AGTL	<u>111.9</u>	<u>94.1</u>
	<u>\$447.1</u>	<u>\$376.5</u>

Q & M proposed that its capital structure would be in the ratio of 75 percent debt and 25 percent equity. The joint venture company would be deemed to have a 75/25 debt-equity ratio. This ratio was selected by Q & M as being close to optimum in a regulated industry.



Q & M stated that it intended to project-finance its interest in the joint venture by raising long-term funds directly from the Canadian banking system and institutional markets and that it would attempt to negotiate 15-year bank term financing with a 20-year amortization and a balloon payment. The interest rate that the Applicant would try to arrange would be in the range of prime of London Interbank Offered Rate plus 1.25 percent. The Company intended to arrange a cost overrun provision relating to the debt to be raised.

Q & M testified that the experience gained by AGTL and its subsidiary companies in financing previous projects would enable it to raise its share of the joint venture financing. Because of this experience it was not considered necessary to conduct research to determine the availability of funds.

The equity funds to be contributed to the joint venture would be raised by issuing shares of Q & M, to be held by AGTL. Q & M testified that its verbal agreement with TransCanada included an option to Petro-Canada Exploration Inc. to acquire 20 percent of the shares of Q & M because Petro-Canada Exploration Inc. had advanced 40 percent of the funds required for the study phase of the project. The public could participate in the project by purchasing shares of AGTL. Q & M expected to arrange a cost overrun commitment with equity-holders, and AGTL testified it would be prepared to meet proportionately any cost overruns.

In the event that there were no assignment of certificates to the joint venture, the amounts and types of funds required to finance the facilities for which Q & M applied can be summarized as follows:

	Export Case	Non-Export Case
	(\$ millions)	(\$ millions)
Long-term Debt	\$384.2	\$306.1
Equity	<u>128.3</u>	<u>101.9</u>
	<u>\$512.5</u>	<u>\$408.0</u>

Q & M did not give evidence or describe the financial plan that would be used to finance the facilities for which it applied, other than the evidence summarized above, since its participation in the project was on the basis of a joint venture.

#### 7.2.3.2 Views of Intervenors

No intervenor commented on the financing plan proposed by Q & M.

#### 7.2.4 Views of the Board

With respect to sales contracts, the Board recognizes it would be unrealistic to expect these to be available until franchise rights had been awarded in the Provinces of New Brunswick and Nova Scotia and until incentive and pricing agreements finalized. If a certificate were issued to Q & M, the Board would require all pertinent sales contracts to be filed prior to the commencement of construction.

With respect to tariff matters, the Board notes that Q & M supported TransCanada's proposals for an extension of the Eastern Zone and development rates. The views of the Board on these matters can be found in section 7.1.4. With respect to the pro forma gas transportation tariff, the Board believes that the cost of service type tariff might be appropriate for the transportation service proposed to be provided by Q & M, but, at this time, it is not prepared to give consideration to approving the pro forma gas transportation tariff filed during the hearing. The Board would propose to review all tariff matters at a subsequent Part IV hearing.

The Board believes that the financing plan prepared by Q & M to finance its 50 percent share of the cost of the facilities proposed by it and TransCanada is feasible. However, any certificate issued to Q & M would require it to satisfy the Board that appropriate arrangements have made for financing the additional pipeline, before construction commences.

CHAPTER 8  
ECONOMIC ASSESSMENTS

8.1 TransCanada

8.1.1 Macroeconomic Impact

8.1.1.1 Evidence of the Applicant

In assessing the macroeconomic impact of its proposed pipeline, and the associated gas production, TransCanada relied on the use of an input-output model and multiplier analysis. To estimate the impact on Gross Domestic Product at Factor Cost (GDPFC), the Dagenais-Martin (D-M) study, filed by TransCanada, used an input-output model to calculate the indirect expenditures from the Applicant's expenditures data which had been adjusted downward to take account of import and tax leakages. A GDPFC multiplier was applied to the direct plus indirect effects to arrive at the total effect (direct, indirect, and induced effects). TransCanada's consultants made three independent estimates of the GDPFC multiplier and settled on a value of 1.85. This value was calculated from simulations using the Bank of Canada RDX2 model and lay in the middle of the range between their other two estimates. The impact on employment, tax receipts, and imports was derived from the effect on GDPFC by using estimates of appropriate marginal or average coefficients.

The D-M study estimated the impact on the Canadian economy using expenditures which related to TransCanada's original application for a pipeline to Halifax and were not changed to reflect its revised application for a pipeline only as far as Quebec City.

The results, as summarized in Table 8-1 below, show the cumulated impact of the project's expenditures over the period 1980-1999. The expenditure data include both capital and operation and maintenance expenditures for the transmission and distribution networks in Quebec and the Maritimes in addition to investment by gas producers and carriers to supply the additional volume of gas required by the market expansion.

Table 8-1

TRANSCANADA'S ESTIMATE OF THE IMPACT ON THE CANADIAN ECONOMY  
OF PROJECT-RELATED EXPENDITURES AS IN ITS ORIGINAL  
APPLICATION FOR A PIPELINE BETWEEN MONTREAL AND HALIFAX

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(\$1979 Millions)

Expenditures	4,954.4
Direct and Indirect Effects	7,186.8
Total Effect on Gross Domestic Product	13,295.5
Increase in Employment (Thousands of Man-years)	409.2
Increase in Imports	2,025.1

#### 8.1.1.2 Views of the Board

It is the Board's view that TransCanada's use of the expenditures data relating to its original application for a pipeline between Montreal and Halifax would not yield a significantly different impact in a macroeconomic context as compared with an impact using the expenditure data relating to a combined TransCanada/Q & M project. However, the Board is of the opinion that stating results on a cumulated basis without regard to the annual pattern of the estimated impacts does not provide a useful measure of the impact of the two projects.

The Board has used the CANDIDE 1.2M econometric model to assess the combined impact of the TCPL and Q & M projects. CANDIDE incorporates an input-output model, and combines industrial detail within a dynamic framework.

The Board's study analyses the effects of not only the construction and operation of the transmission and distribution systems, but also the anticipated gas production. The Board used, as a control case against which to assess the impact, its medium case macroeconomic forecast, which is detailed in the Licence Phase Report. The Board's analysis of the macroeconomic impact indicates that both projects could easily be accommodated by the Canadian economy. This is indicated by the relatively small impacts estimated for each year in the period to 1985, which are detailed in Table 8-2.



Table 8-2

NEB ESTIMATE OF THE COMBINED IMPACT OF THE TCPL  
AND Q & M PROJECT EXPENDITURES ON THE CANADIAN ECONOMY

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Increase in Gross National Expenditures						
(\$1979 millions)	230	326	589	479	528	594
(percent)	.08	.12	.20	.16	.17	.18
Increase in Employment						
(Thousands of Man-years)	5	8	13	12	12	13
(percent)	.05	.07	.12	.11	.11	.11
Increase in the Government Budget Balance						
(\$current millions)	108	145	298	214	243	302
(\$1979 millions)	99	125	241	163	174	204
Net Increase in the Current Account Balance						
(\$current millions)	-92	-78	38	196	303	409
(\$1979 millions)	-84	-67	31	149	217	276

Most of the increase in gross national expenditure is due to higher consumer expenditures, a result of higher personal income generated by the project. The impact on the balance of payments is a result of oil imports being backed out by gas penetration in Quebec and the Maritimes, offset by increased imports of other products, primarily automobiles and parts, and other manufactured goods. The net effect is an improvement in the current account balance in every year except 1980 and 1981. By 1985 the current account should be improved by \$409 million. This result assumed a fixed exchange rate throughout the period.

The employment impact comes primarily in the services-related industries: trade, finance and personal services. There is also a significant increase in employment in the manufacturing, mining and construction industries.

It is the Board's view that the likely macroeconomic impacts resulting from TransCanada's and Q & M's proposed pipelines are quite small and could be absorbed by the Canadian economy without problem. The impact of TransCanada's pipeline alone would be even smaller, and it was for this reason that the Board did not do a separate analysis for each Applicant. The overall impact should be beneficial. Of greater importance is the impact on Canada's regions, specifically Quebec and the Maritimes. A discussion of the regional impact is contained in later sections of this report.

### 8.1.2 Regional Social and Economic Impact Assessment

#### 8.1.2.1 Evidence of TransCanada

##### Introduction

On matters of regional and socio-economic impact, TCPL provided the Board with extensive urban and regional analyses of impact areas in Quebec.

For the proposed pipeline route between Montreal and Quebec City and westward between Montreal and Thurso, TCPL provided studies which identified the physical impact of the proposed natural gas pipeline on several urban land uses, particularly residential, industrial, commercial and institutional. The studies also included an inventory of public service facilities located in the principal urban areas along the pipeline route. The studies aimed at identifying the proposed project's interface with urban development so as to avoid or minimize the negative side-effects of the proposed routing.

In respect of the Eastern Townships, TCPL provided, in addition to studies similar to those described above, a regional overview of the Eastern Townships region. The regional overview presented base data concerning the physical, demographic and economic characteristics of the region; the relative importance of regional and urban functions; and the zones of economic influence of the towns to be served, and their interrelationships.

TCPL also submitted a regional overview study for the Saguenay/Lac St-Jean region along the lines submitted for the Eastern Townships.

Under cross-examination, TCPL explained that additional studies had been carried out for the regions of Beauce, Lac St-Jean and Marbleton. These additional studies were said to be similar to those filed for other regions, i.e., regional overviews and/or urban and regional analyses. These additional studies were not completed prior to the end of the hearing and could thus not be entered into the record.

In addition to the above routing studies, TCPL provided the Board with a study of the possible economic impact of the TransCanada project on the Quebec economy. The study covers the period 1980 to 2000 and measures the possible impact of the construction and operation of both the transmission and distribution systems. The Applicant evaluated the direct, indirect and induced economic effects of the project on the Quebec economy.

#### Description of the Project

Construction of transmission facilities in the Province of Quebec was scheduled to be completed over a four-year period starting in May 1980. Construction of the distribution facilities would take place throughout the 1980 to 2000 period, with activities reaching their peak between 1984 and 1990.

Over the 1980 to 2000 period, TCPL expected to spend \$541.3 million (constant \$1979) for the construction of the transmission system in Quebec up to Lévis-Lauzon and \$279.7 million for the operations and maintenance of the system. On the distribution side, TCPL estimated the capital expenditures, from 1980 to 2000, to total \$913.4 million, while operations and maintenance expenditures would add up to \$799.9 million.

Summing the expenditures for both the transmission and distribution systems in Quebec, total capital expenditures were expected to reach \$1,454.7 million and operations and maintenance expenditures \$1,079.6 million for a grand total of \$2,587.6 million if conversion costs of \$53.3 million for Quebec are included.

With respect to direct employment on the proposed project, TCPL has estimated some 6,000 man-years could be required in the construction of the transmission system while 5,000 man-years could be needed to operate and maintain this system over the 1980 to 2000 period. On the

distribution side, direct construction manpower requirements were assessed to be in the order of 12,000 man-years, and operations and maintenance requirements in the order of 30,000 man-years over the 1980 to 2000 period. Operations and maintenance manpower requirements for the distribution system would thus average about 1,400 man-years annually.

With respect to operations and maintenance, the combined TCPL and Q & M project has planned to site its head office in a major Quebec urban center located near the pipeline route. It is anticipated that upwards of 110 permanent jobs (including the support staff) would be created to man this head office. Moreover, TCPL has planned to establish an area office, probably located in Quebec City, where some 18 permanent jobs would be created. Finally, three district offices would be located along the transmission system in St-Hyacinthe, Joliette and Quebec City in which the number of permanent jobs could involve 20, 31 and 57 people, respectively.

#### TCPL's Regional Social and Economic Policies

TCPL indicated that it would rely on policy statements made by Q & M on socio-economic matters.

TCPL indicated that, where its consultants had made recommendations for routing changes to avoid negative side effects of the project, TCPL would be prepared to consider and deal with these recommendations during final alignment.

TCPL stated that a considerable amount of consultation had taken place with the municipalities situated along the proposed transmission lines. During these consultations, the concern most often expressed by communities, particularly the smaller ones, centred on the location of the right-of-way and related matters. TCPL also pointed out that there was much interest in knowing more about natural gas. Overall, TCPL expressed the feeling that consultation with the communities had been useful in the planning of the project. TCPL stated that, with respect to the construction and operations phases of the transmission system, its policy in matters of community meetings would consist of holding such meetings wherever there would be a need or a desire indicated to this effect.



In respect of accommodation for construction employees, TCPL expected that the contractor on the Lac St-Jean lateral would probably require a camp because of the remoteness of the location. For other areas, TCPL expected that construction workers would find accommodation in communities along the route even if this meant driving some distance. It was pointed out that this practice was quite usual for contractor personnel.

On matters of use of local infrastructure and services, the Applicant expected to make use of these facilities for its project and pointed out that, in its view, such facilities were adequate to meet both local and project needs. Moreover, TCPL added that it had mechanisms in place to ensure that local services did not become overloaded as a result of the project.

Turning to the subject of local purchasing of goods and services or local content, the Applicant proposed to maximize local content consistent with competitive pricing, quality and timing requirements for the availability of goods and services. The Applicant added that it would try to facilitate the participation of local business in project-related business opportunities and, to this end, would advertise for local suppliers to prepare bids. With respect to the operations phase, the Applicant explained that district offices tended to have more opportunities to develop local sources of supply.

Finally, as regards use of local labour, the Applicant indicated that contractors were expecting that about 80 percent of the construction employment manpower could be filled by local labour. TCPL testified that it encouraged contractors to hire locally. In respect of the operations phase, TCPL indicated that it had a skill development program in place which made use of on-the-job training as well as self-pace individual learning systems.

#### Description of the Impact

In terms of socio-economic impact, TCPL relied essentially on the work of the consultants who prepared the "Urban and Regional Analyses". For those areas which had been documented by the close of the hearings, i.e., the mainline from Montreal to Quebec City including the

Thurso lateral plus the Eastern Townships, the consultants generally concluded that "the proposed natural gas pipeline would not have a major physical impact on the urban areas through which it passes". Moreover, the consultants pointed out that, where it did interface with urban development, it had been routed in such a way that negative side-effects were minimized or, at least, that such side-effects were identified and documented for consideration during final design.

On matters of economic impact, TCPL filed a consultant's report dealing with the economic impact of its proposed system on the economy of Quebec. This study measured the impact of the construction and operation of the proposed pipeline systems plus the impact of the expenditures required to convert present fuel-burning equipment to gas-burning equipment.

The results took into account the direct, indirect and induced effects of the proposed project. TCPL defined the direct effects as those economic effects directly connected to the project; the indirect effects of the project as those deriving from the fact that the realization of the project would require the use of materials and supplies produced by several different industries and; finally, the induced effects as those deriving from the fact that the additional incomes generated through the project would also give rise to a chain reaction of additional consumption and investment expenditures.

The impact of the project was measured in terms of increased gross domestic product at factor cost (GDPFC), in terms of employment generated, government tax receipts and imports (i.e., from other provinces rather than imports from other countries). The estimates of impact included all receipts from direct taxes such as income tax and indirect taxes such as sales tax.

It was pointed out that this type of measurement of impact implied that there were enough unemployed resources in the economy to allow the realization of the predicted effects. Furthermore, it was assumed that the resulting increase in effective demand would create no bottleneck in the economy. These assumptions, the Applicant indicated, suggested that the measured impact was, in some sense, a maximum.

Table 8-3

TCPL ESTIMATE OF THE POTENTIAL ECONOMIC IMPACT OF THE  
PROPOSED TCPL AND RELATED DISTRIBUTION FACILITIES IN QUEBEC  
1980 TO 1990 AND 1980 TO 2000

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(\$1979 millions)

	<u>1980-1990</u>	<u>1980-2000</u>
Total Project Expenditures <sup>(1)</sup>	1,375.6	2,587.6
Impact:		
1. Increase in GDPFC		
Direct and Indirect Effects	1,988.2	4,417.7
Total Effects	3,181.1	7,068.3
2. Increase in Employment (Man-years)		
Direct and Indirect Effects	40,036	76,712
Total Effects	93,717	195,990
3. Increase in Government Tax receipts <sup>(2)</sup>		
(a) All Government Levels Direct and		
Indirect Effects	458.3	1,005.9
Total Effects	904.5	1,997.2
(b) Quebec Government		
Direct and Indirect Effects	218.2	447.9
Total Effects	447.3	956.8
4. Increase in Imports <sup>(3)</sup>		
Direct and Indirect Effects	195.0	297.9
Total Effects	791.5	1,623.2

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(1) Includes capital, operations and conversion costs but excludes fuel gas costs, land costs, municipal taxes and corporate income taxes.

(2) Excluding municipal taxes and corporate income taxes paid by the transmission and distribution companies.

(3) From the rest of Canada as well as from other countries.

TCPL noted that project-related land purchases had not been taken into account since such transactions did not affect the gross domestic product. In addition, TCPL pointed out that only the "backward effects" had been taken into account in the impact measurements and that forward effects such as the attraction of new investments or additional migration were not included. TCPL also added that the measurements did not take into consideration the negative impact the project could have on refineries and oil distributors.

The direct effects of the project were those project expenditures which resulted in the purchase of goods and services produced in Quebec, and these were inferred from the nature of the expenditures associated with the project. The evaluation of the indirect effects was made by feeding the direct expenditures into an input-output model for the Quebec economy. Finally, the evaluation of the induced effects on GDPFC relied on the use of a multiplier. A GDPFC multiplier of 1.6 was used for Quebec.

The results of TCPL's analysis are summarized on Table 8-3. Over the 1980 to 1990 period, the project would result in an increase of \$3,181 million in gross domestic product (at factor cost) and could generate as much as 93,700 man-years of employment throughout the Quebec economy. Over the 1980 to 2000 period, TCPL estimated the increase in GDPFC, as a result of the proposed project, to be in the order of \$7 billion while the employment generated could reach close to 196,000 man-years. Over and above municipal taxes and corporate income taxes paid by the transmission and distribution companies, revenues accruing to the Quebec government could increase by as much as \$1 billion over the 1980 to 2000 period.

#### 8.1.2.2 Views of Intervenors

The views of intervenors have been presented elsewhere in the report. In this section, the focus will be on those interventions received from interested parties resident within the project area, with a view, primarily, to setting out their assessment of the regional social and economic impact of the proposed project on their regions or provinces.



The Government of Quebec felt that natural gas should reach as many regions in Quebec as possible, and it indicated its support for intervenors from various regions of Quebec who came before the Board with requests for having the proposed project extended into their respective areas. In addition to demonstrating interest in the economic spillover effects associated with the construction and operation of the proposed systems, Quebec cited natural gas as being an important industrialization factor. In its view, penetration of gas could contribute to industrial development, based on the premise that gas would be sold at competitive prices within the Province.

Quebec advocated that the proposed project should be routed so as to allow the early production of existing Quebec gas reserves along the south shore, downstream of Trois-Rivières. The Province also testified that, during provincial hearings in Quebec, while some specific concerns had been raised by various communities, no real objections to the project had surfaced.

The Conseil de Développement de la Haute-Mauricie explained that its area was hoping to attract new industries in the pulp and paper sector, and it said that if gas were not made available to that area, while it was available in other areas, industrial opportunities would be lost. It recommended to the Board that any certificate issued to TCPL should be conditioned so as to ensure that the pipeline would reach La Tuque.

The Corporation de Promotion Industrielle de Sept-Iles recommended that the Board grant a certificate to TCPL with the condition that an LNG plant be located in Sept-Iles as initially planned by TCPL. In its opinion, natural gas would enhance the viability of existing mining concerns in the region and would constitute an important factor in terms of attracting new industries. Natural gas, according to the Corporation, could become a tool for economic development and would permit a more rapid industrialization of the region.

The Conseil Economique Lévis-Lauzon said that it wished to receive natural gas service and thus be assured of security of supply. According to the Conseil, natural gas would be a determining factor on

the economic development of their region by providing an additional feature to attract industry.

The Association des Commissaires Industriels du Quebec recommended that the Board proceed as quickly as possible to certificate the proposed project. In its view, it was important that all regions of Quebec have the opportunity to be supplied with natural gas so as to provide the Province with the possibility of consolidating and diversifying its economic structure. The Association felt the security of supply aspect associated with natural gas was an extremely important factor in relation to industrial development. The Association also supported a uniform price for gas throughout all regions to be serviced in Quebec in order not to create any regional disparities. In conclusion, the Association stated that, if delays were encountered with respect to the project or if certain regions were not supplied with gas, numerous investments in the Province would not take place and the Province would be penalized in terms of foregone employment and lost taxes.

Finally, UPA was not opposed, in principle, to the proposed project. It requested, however, that the proposed routing have a minimal impact on agriculture and that all studies required to attain this, be undertaken. The Union described a number of specific problems related to the impact of pipeline construction on agricultural lands which are discussed in the environmental section of the report. In view of these problems, the Union wished to have the project right-of-way follow existing transportation corridors.

#### 8.1.2.3. Views of the Board

TransCanada's socio-economic assessment contained a considerable amount of information on the evaluation of the land-use impact of the proposed project but did not incorporate, to any significant extent, an evaluation of the likely impact of the project on local socio-economic and institutional services and facilities. Furthermore, similar information on additions to the proposed project - such as Marbleton, Dolbeau and La Beauce - was not submitted in time to

be included in the record, although limited impact information on these areas was obtained through cross-examination during the hearing.

The Board notes that the proposed routing traverses fairly densely populated areas. Summing the population of major urban centres along the route shows that between St-Lazare and Quebec City, the proposed project would serve a population of over 800,000 (excluding Montreal), while the Lac St-Jean lateral would serve a population of over 200,000, the Beauce lateral about 35,000, and the Eastern Townships about 400,000.

The Board acknowledges that the areas to be traversed by the project are generally well-endowed in social and economic infrastructure and services. The Board does not believe that the proposed project, particularly during the pipeline construction period, would pose any major problems in terms of overloading local facilities and services. With the possible exception of the Lac St-Jean lateral, virtually all of the proposed route is so situated and served by the existing road system that there should be no difficulty in accommodating and meeting the needs of the workers without jeopardizing services to the local population. Requirements imposed on the regions by the project could easily be spread over a number of communities.

The Board commends the Applicant on its community liaison and consultation program and expects the Company to sustain these efforts, particularly during the construction phase, if the project is certificated.

The Board notes TCPL's commitment to adopt Q & M's policies on socio-economic matters and the Board fully expects TCPL to carry out those policies. With respect to employment, the Board expects TCPL to follow up on the need for an efficient manpower delivery system, training, and preferential hiring for local residents. On the local business side, TCPL is expected to provide an information program and to ensure that its purchasing policies reflect the special circumstances and needs of local businessmen. On this basis, the Board believes that the proposed project could generate significant employment and business opportunities in the Province of Quebec.



The Board also notes that interventions filed from within the Province of Quebec have been quite favorable to the pipeline project. The major concern of most regional intervenors was that the project should be extended to include their respective regions. However, UPA expressed concerns mainly of an environmental and land-use nature and they are discussed in other sections of the report.

Overall, the Board recognizes that the proposed project is routed through areas of Quebec which are well developed socially and economically, and which, for the most part, have experienced the impact of major projects of one type or another in the past. Thus from a socio-economic point of view, the Board does not expect the proposed project to create any significant disturbances within the communities situated along the right-of-way.

The Board accepts as reasonable the methodology used by TransCanada to estimate the economic impact of the project on Quebec. The Applicant made use of an up-to-date and comprehensive technique and has followed established procedures. However, the Board's estimates of impact are significantly lower than those of the Applicant, primarily, it would appear, because of the Applicant's treatment of import leakages.

Furthermore, in regard to the induced economic impacts, the Board does not agree with the adjustment made by TransCanada to capture the further effects of undistributed corporate profits and capital cost allowances generated by the project. This step was probably not necessary because, first, further investment in the provincial economy was not a prerequisite for the project and, secondly, it is virtually impossible to predict how or where profits will be reinjected into the economy.

The Board's estimates of regional impact rely substantially on the evidence but were derived using the Statistics Canada Regional Input-Output Model. The model portrays the structure of the national and provincial economies in terms of the interrelationships among some 191 industries and 733 commodities. The impact estimates show the inputs (material and labour) needed to build and operate the proposed project



and the economic activity that the construction and operation of these undertakings will induce in the Province of Quebec. The estimates take into account the spending of income received by employees of the pipeline or distribution companies and all of their suppliers but exclude consideration of how undistributed corporate profits and capital cost allowances might be reinvested. As the model provides a static "snap-shot" of the structure of the economy, its results cannot indicate the annual pattern of the impact of the pipeline on the economy. Therefore, the Board's estimates show the aggregate impact of all expenditures over a certain period (1980 to 1990) as if all necessary inputs were to come from unemployed sources rather than from alternative uses. Technical notes on the Board's regional economic impact assessment can be found in Appendix 8-A.

The Board's estimation of the share of direct provincial expenditures (out of total project expenditures), as well as its estimation of the distribution of input requirements, rely heavily on information put forward by Q&M for the combined projects.

The income multiplier generated by the model is based on project (transmission and distribution) expenditures in Quebec up to the year 1990. The provincial economic impact is also tabulated for the 1980 to 1990 period.

While the Applicant provided estimates of regional economic impact in the Province from construction and operations expenditures of the project over the 20-year period from 1980 to 2000, it is the view of the Board that, especially when considering regional economic impact in any industrially developed region, any such impact estimate should be limited to a period of some 5 to 10 years at the maximum. One major reason for this is that impact analysis assumes no supply constraints on resource inputs, in particular on labour inputs, which becomes a less and less acceptable assumption as the impact forecast extends into future years.

The results of the Board's analysis, which does not include the proposed exports by Q & M at St. Stephen, i.e., the non-export case, are presented in Table 8-4. The economic impacts are presented in terms of

increases in gross domestic product at factor cost (GDPFC). GDPFC measures the value of domestic production, net of indirect taxes. As for project expenditures, the Board's estimates, like those of the Applicant, do not incorporate the cost of land, fuel gas costs, municipal taxes, or corporate taxes paid by the transmission and distribution companies.

From Table 8-4, it can be seen that project expenditures over the 1980 to 1990 period, would ultimately result in an increase in the Quebec GDPFC of \$1,003 million. On the employment side, the Board estimates that the project would generate in the area of 30,500 man-years over the same period. Applying the Applicant's methodology, it can also be estimated that the project's impact could result in increasing total government tax receipts by \$268 million and provincial government tax receipts by \$139 million over the 1980 to 1990 period.

Over and above the estimates of total provincial impact, the Board estimates that the project will have an additional direct economic impact on the Province in the form of direct municipal and corporate taxes paid by the transmission and distribution companies. The indirect and induced effects of these expenditures have not been measured. In any case, as a minimum, the total provincial economic impact would be increased by some \$122 million up to 1990.

Conversion costs have been excluded from the analysis. However, over the 1980 to 1990 period, these would represent sizeable expenditures in the Province of Quebec which could generate in the area of 400 man-years of employment.

In an ideal situation, a regional economic impact assessment would also consider the economic impact on Quebec of project expenditures taking place in other provinces or of additional flows of exports induced by the rise of incomes in other provinces as a result of their extra sales to the impact region (feed-back effects). While the Board's analysis was not this comprehensive, the results from the model did indicate that the total employment impact in Quebec could be increased by as much as 12 percent through project expenditures being made directly in other Canadian provinces.

Table 8-4

NEB ESTIMATE OF THE POTENTIAL ECONOMIC IMPACT OF THE  
PROPOSED TRANSCANADA PIPELINE PROJECT ON QUEBEC  
1980 - 1990

(\$1979 millions)	
	<u>1980 -1990</u>
(1)(3)	
Total Project Expenditures	1,016.4
(2)(3)	
Direct Provincial Expenditures	686.9
Total Increase in GDPFC (Including Direct, Indirect and Induced Effects)	1,003.0
Direct Municipal Taxes	87.1
Total Direct Corporate Income Taxes <sup>(4)</sup>	138.7
Total Project Manpower Requirements (Man-years)	16,411
Direct Provincial Manpower Requirements <sup>(5)</sup> (Man-years)	15,645
Total Employment Impact (Man-years)	30,500
Total Increase in Government Tax Receipts <sup>(6)</sup> (7)	
All Levels of Government	268.2
Quebec Government	138.7

- 
- (1) Includes the Board's estimates of capital and operating costs for transmission and distribution systems. Excludes conversion costs and fuel gas costs.
- (2) Derived from total project expenditures by using the proportions calculated by Q & M in Exhibit 22-108.
- (3) Excluding land costs, municipal taxes, and corporate income taxes paid by transmission and distribution companies.
- (4) Of this total, the provincial share is assumed to be 25 percent from Q & M, p. 5f-8R, Exhibit 22-9. Total corporate income taxes are "normalized" tax revenues.
- (5) Derived from total project manpower requirements by using the proportions calculated by Q & M in Exhibit 22-108.
- (6) Using proportions assumed by TransCanada.
- (7) Excluding municipal taxes and corporate income taxes paid by transmission and distribution companies.



The Board's approach also allows for a partial evaluation of the inter-regional effects of the TCPL project. For example, according to the Board's analysis, the TCPL project could create additional employment in Ontario of the order of about 75 percent of the total employment impact in Quebec. This additional employment results from project expenditures being made directly in Ontario and from increased economic activity generated in Ontario from project expenditures being made directly in Quebec. If the employment impact can be taken as a proxy for income impact, the proposed project could have a sizeable impact on the Ontario economy.

In summary, the Board is of the opinion that the project should not conflict, in any significant way, with the social and economic activities of communities situated along the proposed routes. On the other hand, the project offers the possibility of generating a substantial amount of economic activity, and, thereby, of contributing to a lower unemployment level in the Province of Quebec.

In conclusion, the Board is confident that the proposed pipeline and associated distribution facilities can be built without raising any significant socio-economic problems and believes the project could bring economic benefits to the Province of Quebec.

### 8.1.3 Refinery Impact

#### 8.1.3.1 Evidence of the Applicant

To address the impact of gas penetration on the oil refining industry in Quebec, TCPL submitted a study conducted by its consultant, Hycarb Engineering. This study analyzed the technical capability of the refining industry in Quebec and the Atlantic Region to adjust to gas penetration and the impact of gas penetration on the profitability of refining operations.

Industry refining operations were simulated for 1977 using a linear programming model which employed Statistics Canada data and information obtained by Hycarb through "industry contacts". The approach assumed that the industry could be treated as a composite refinery and as such did not consider the impact on individual refiners. Data inputs included mid-1978 refinery product and crude prices, actual production,



product specifications, and crude slate. Industry operating margins were defined as the difference between crude costs and refinery gate product prices.

Future operations were simulated for a base case employing petroleum product projections and domestic crude oil availability as contained in the Board's 1978 Oil Report. It was assumed that current spare capacity in the industry would be sufficient to absorb growth in product demand and that no investment would be required to increase conversion capability.

To analyse the effect of gas penetration, demands on the refineries were reduced by the amount of heavy and light fuel oils it was estimated would be displaced by TCPL. The reduction in crude rate assumed that the mix of imported crudes would be lighter than in the base case.

Hycarb concluded that the refining industry could technically accommodate gas penetration, that is to say, the existing capacity and conversion facilities could reduce fuel oil yields while meeting the forecasted demands for other products. Consequently, the reduction in the crude rate was approximately the same as the reduction in demand for light and heavy fuel oils resulting from gas penetration.

The base case projections indicated that heavy fuel oil yields would remain approximately constant at the 1977 level of 25 percent of production until 1990, increasing to 29 percent by the year 2000. In the gas penetration case, heavy fuel oil yields declined to 18 percent in 1990 and 19 percent in 2000.

Changes in operating margins, relative to 1977 levels, were calculated at five-year intervals over the period 1985-2000 for the base case and gas penetration case, assuming the product prices and crude oil costs in early 1978, and taking into account changes in refinery operating costs. Hycarb utilized the difference in the change in margins in the two cases as an indicator of the impact of gas penetration on refiners' profitability. Refining margins were estimated to improve in future years with gas penetration relative to the "very low" 1977 level. Hycarb's projections to the year 1985 indicated that the improvement in

refining margins would be slightly higher in the gas penetration case primarily because the saving in crude and operating costs was greater than the loss in revenues from heavy fuel sales. After 1985, the improvement in profitability relative to the 1977 level would be less in the gas penetration case as the impact on the sales of relatively high value light fuel oil became more significant.

Based on Hycarb's assessment of the effect of gas penetration on the profitability of future refinery operations, Q & M estimated in its cost-benefit analysis, that reduced profitability in Quebec and the Atlantic Provinces over the period 1980-2000 would have a present value of \$52 million in 1979 dollars. The data provided indicated that the reduction in Quebec would be \$37 million.

Hycarb's analysis assumed that hydroskimming operations would continue at the recent levels of capacity, and, consequently, the future improvement in refining margins would likely accrue to refiners with conversion facilities. Hycarb cited examples of refiners who were considering investments in increased conversion facilities to accommodate the trend toward heavier crude oils. Such investment would aid the industry in adjusting to gas penetration.

Sensitivity analyses were also undertaken to evaluate the effect of an increased availability of Canadian crude and to demonstrate the possible improvement in the gas penetration case assuming that the gas oil from hydroskimming operations could be used as feedstock for Montreal catalytic crackers. Hycarb indicated that certain costs relating to such re-processing, for example, transportation, were not taken into account.

#### 8.1.3.2 Views of Intervenors

Interventions by BP, Quebec, and Ultramar addressed the capability of the industry to accommodate gas penetration in conjunction with the trend toward heavier imported crude oils, potential accelerated production of synthetic crude, availability of East Coast supplies, and possible solutions to the additional surpluses of heavy fuel oil that could result from gas penetration.

Suggestions on how heavy fuel oil surpluses might be reduced or eliminated were:

- (i) accelerated investment by the industry in conversion capability;
- (ii) increased exports in view of the possible movement of United States oil prices to world levels;
- (iii) increased availability of Western Canadian synthetic crude or, possibly, domestic East Coast oil to balance the trend toward heavier imported crude oils.

BP was concerned with the future availability of foreign crude oils and stated that to the extent that it was economic, gas penetration should be considered in conjunction with increased synthetic oil from Western Canada.

BP used a linear programming model to simulate the operations of the "average" Quebec refinery. Based on domestic crude oil availability in the Board's 1978 Oil Report and future availability of light foreign crude as required, it indicated that with and without gas penetration, product demands could be met with existing plant. In the gas penetration case, crude runs were reduced by the volume of displaced products, indicating that no product surpluses or shortfalls would result. The volume of products that BP assumed would be displaced by gas penetration was the same as estimated by the Board in its 1979 Gas Report and was lower than the product displacement in the Hycarb analysis. BP could not say if its results would apply to the higher displacement.

BP presented additional cases assuming no availability of foreign light oils. These cases demonstrated that increased availability of synthetic crude in conjunction with gas penetration could eliminate shortfalls of light products and surpluses of heavy fuel oil, which would result if foreign heavy crude totally replaced foreign light crude.

BP stated that some Quebec refiners could require investment in order to run synthetic crude, but was unable to say how large the investment might be.



BP concluded from its study that synthetic crude development, or "other crude developments" were a necessary component of a natural gas substitution policy.

Quebec and Ultramar indicated that refinery investment in increased conversion capability should be part of an overall effort to increase security of supply. If such investments were not made and surplus fuel oils not eliminated, then gas penetration would not reduce imported crude oil demands because refineries would still have to run crude to meet the requirements for non-substitutable products such as transportation fuels.

Ultramar indicated that it was considering the addition of 4 770 m<sup>3</sup>/d of catalytic cracking at Quebec City at a cost of \$100-\$120 million, to improve yields of light products. This upgrading would only take place if Ultramar was assured a secure source of crude supply. In its view, such upgrading was required irrespective of possible future crude supplies off the east coast. Although Hibernia crude could improve refinery product balances, Ultramar stated that sophistication of its refinery, if not of others, was required in any event.

If financial support were to be made available for gas penetration, Ultramar was of the opinion that such assistance should be directed to eastern refiners in order to secure a greater supply of domestic crudes and upgrade refinery operations. It was suggested that if the IPL system were extended to Quebec City, the cost of a 406.4 mm line with a 23 848 m<sup>3</sup>/day capacity would be approximately \$80 million. Ultramar submitted that such an option would be preferable to reversing one line on the Portland Pipe Line System.

In addressing the negative impact of gas penetration on employment, Ultramar estimated that the marketing and distribution of heating oil were 1.8 times more labour intensive than natural gas.

#### 8.1.3.3 Views of the Board

Hycarb's analysis indicated that the reduction in light and heavy fuel oils in Quebec as a consequence of gas penetration would be translated into approximately the same reduction in crude oil



requirements, implying that the industry has the capability to reduce heavy fuel yields. Hycarb's result relies to some extent on the assumption that the mix of foreign crude oils to Eastern refiners would become proportionately lighter in its gas penetration case. In addition, the treatment of the industry in Quebec as a "composite" refinery tends to understate the technical problems faced by certain refiners, particularly those with limited conversion capability.

The Board believes that individual companies would, in the short term, be faced with problems in adjusting to gas penetration of fuel oil markets because natural gas flow would begin in large initial volumes and could do so before "processing solutions" could be put in place. Products necessarily made in the course of meeting demand for transportation fuels in Canada will require outlets in Canada or abroad. The alternative to be considered is the processing of less crude (for lower outputs of heavy fuel oil) and importing light products.

An investment in facilities to upgrade surplus heavy fuel oil would be required if the mix of foreign crudes becomes significantly heavier than at present. Under these circumstances, however, the Board does not expect that any capital expenditures attributable to gas penetration would be significantly greater than those which would normally be expected by an industry adjusting to changing product slates and feedstock requirements.

The manner, timing and costs of adjustment are, however, extremely difficult to predict with any degree of certainty. This is because actual decisions by individual refiners in such circumstances are taken in the light of a wide range of corporate judgements such as the relative profitability of alternative investments, the future availability and quality of feedstocks, and domestic and export marketing opportunities for oil products (including imported product). Furthermore, not all of these decisions are likely to be implemented in full coordination.

Even without gas penetration, it is likely that additional investment would have to be made in existing refining facilities to accommodate the potential trend to heavier crude oils and to improve

longer term profitability. The Board has heard evidence at previous inquiries and at this hearing that such improvements are contemplated and recognizes that investment decisions are further complicated by the possible availability of domestic light crude oil from the East Coast and increased utilization of synthetic crude from Western Canada.

The Board notes that its own forecast of gas penetration is lower than that of TCPL. To the extent that this is the case, it would indicate less difficulty for the industry to adjust, although, because of the creation of spare capacity resulting from reduced product requirements, the profitability of future refining operations would be reduced. The Board has estimated in its cost-benefit analysis that reduced profitability over the period 1980-2000 would have a present value of \$42 million in 1979 dollars.

#### 8.1.4 Canadian Content

##### 8.1.4.1 Evidence of the Applicant

In discussing the importance of Canadian content in its purchasing decisions, TCPL stated that its policy was to secure Canadian manufactured goods and services where these were available, consistent with quality, price, and deliverability. TCPL submitted that it had been able to increase the Canadian content of purchased materials from approximately 25 percent in 1956 to over 90 percent on recent projects. During this period, it had encouraged Canadian suppliers to expand plant capacity and to actively seek and obtain export orders. TCPL indicated that the prospect of obtaining large orders for pipeline materials and equipment was an incentive for manufacturers to establish facilities in Canada, particularly when TransCanada had made it known that Canadian content would be a consideration in the decision to purchase.

The Canadian content estimates were based on "ultimate" Canadian content which recognized that items manufactured in Canada often incorporate imported components. TCPL submitted that its estimates were preliminary since they were based on information provided by probable bidders. But its analysis showed that these estimates were in agreement with those of Q & M on the Canadian content that could be achieved on specific items such as line pipe, other pipeline components and compression equipment.

TCPL filed Canadian content information relating only to the facilities required for the export case. Data filed by TCPL indicated that the Canadian content of its facilities would be 93 percent, based on capital expenditures of \$384 million in 1979 dollars over the period 1980-1989. It stated that the percentage of Canadian content estimated would be the same if expenditures made over the period 1990-2000 were taken into account.

TCPL provided a breakdown of Canadian content of materials and installation by major expenditure categories. TCPL's estimate is summarized in Table 8-5.

The Canadian content of line pipe was 91 percent based on an allocation of products between STELCO and IPSCO. The non-Canadian content was accounted for by the need to import certain materials such as ferro-alloys and raw materials used in the steel-making process.

Expenditures on pipeline installation were accounted for mainly by labour, equipment, fuel and contractors' overhead. This category had a Canadian content of 93 percent, although in dollar terms, it accounted for the largest portion of non-Canadian content. This was because of the necessity to use construction equipment with a relatively low Canadian content and the use of fuel produced from imported oil.

Expenditures on compression equipment, pipe, valves and fittings and other materials required for compressor stations had a Canadian content of 89 percent. Depending on the type of compression unit and the supplier, TCPL indicated that there could be a variation in the Canadian content actually achieved. For example, gas turbine-driven centrifugal units were assumed to have an average content of 70 percent with estimates for individual suppliers varying from 60 to 85 percent. The average content of electric-driven reciprocating units was 85 percent based on a survey of two suppliers whose estimates were about the same.

The import content of compression equipment was accounted for by components and "specialty" materials not manufactured in Canada such as gas generators, turbine rotors, and blades.

Table 8-5  
TCPL ESTIMATE OF CANADIAN CONTENT<sup>(1)</sup>

	<u>Expenditures (\$1979 Millions)</u>			<u>Percentage</u>
	<u>Total</u>	<u>Canadian Content</u>	<u>Non-Canadian Content</u>	<u>Canadian Content</u>
<u>Land and Land Rights</u>	10.4	10.4	-	100
<u>Pipeline</u>				
- Materials	60.8	55.5	5.3	91
- Installation	<u>189.9</u>	<u>175.9</u>	<u>14.0</u>	<u>93</u>
- Total	250.7	231.4	19.3	92
<u>Compressor Stations</u>				
- Materials	38.7	34.5	4.2	89
- Installation	<u>8.2</u>	<u>7.9</u>	<u>.3</u>	<u>96</u>
- Total	46.9	42.4	4.5	90
<u>Meter Stations and O &amp; M</u> (2)				
- Materials	12.9	10.5	2.4	81
- Installation	<u>6.4</u>	<u>6.1</u>	<u>.3</u>	<u>95</u>
- Total	<u>19.3</u>	<u>16.6</u>	<u>2.7</u>	<u>86</u>
Total Direct Costs	327.3	300.8	26.5	92
Indirect Costs <sup>(3)</sup>	<u>56.3</u>	<u>54.9</u>	<u>1.4</u>	<u>98</u>
Total Costs	383.6	355.7	27.9	93

(1) Based on Exhibit 22-146. Expenditures required in the export case over the period 1980-1989.

(2) Operation and Maintenance Facilities.

(3) Includes Engineering, Project Management and Contingencies.



The Canadian content of valves and fittings included in pipeline and compression station materials was estimated to be 85 percent. Estimates from suppliers surveyed ranged from 20 to 95 percent. Such factors as the availability of valve castings and the lack of manufacturing facilities for large valve sizes were the reasons for the non-Canadian content.

TransCanada stated that project management, engineering and construction management would be carried out by its own staff and by Canadian consultants.

#### 8.1.4.2 Views of the Board

The Board notes that TCPL's analysis referred to the facilities required for the export case. The Board expects the level of Canadian content in the non-export case to be at least as high as that estimated in the export case. The Board notes that there were no submissions by intervenors in respect to Canadian content.

The Board is satisfied with the approach taken by TCPL to estimate Canadian content and finds its estimate to be reasonable. The Board notes, however, that depending on the supplier selected, the Canadian content of items such as compression equipment, valves and fittings could vary significantly. Also, concurrent demand by other large pipeline projects and the capability of suppliers to meet timing requirements may not allow the Canadian content, as estimated, to be achieved.

In view of these possibilities, the actual extent to which industrial benefits to Canada will be realized is not certain. Should a certificate be granted, the Board would require the Applicant to file a report with the Board, within 12 months after leave to open has been granted, indicating:

- (i) in respect of each cost category in Table I of Exhibit 22-146, the percentage Canadian content achieved in comparison to the percentage estimates that could be calculated from the data submitted for TCPL, and the reasons for any variations; and

- (ii) in respect of the expenditures on line pipe, compression equipment, valves and fittings, a statement setting forth the names of Canadian firms invited to make contractual bids and the names of the firms to which contracts were awarded.

#### 8.1.5 Cost-Benefit Analysis

##### 8.1.5.1 Evidence of the Applicant

The cost-benefit study submitted by TransCanada assessed the net economic benefits to Canada of expanding natural gas sales in Montreal and the extension market areas in Quebec by assessing the direct costs and benefits associated with its proposed pipeline project.

TransCanada evaluated its project over a period of 20 years with capital costs allocated according to accounting practices allowed by the Board. Thus, at the end of year 20, the book value of the assets corresponded to the amount to be billed to the customers over the period extending beyond 20 years.

In its analysis, TCPL considered direct economic benefits from a number of sources:

- (i) retail revenues from the sale of natural gas;
- (ii) savings in pollution costs;
- (iii) an increase in security of energy supply;
- (iv) a premium attached to foreign exchange savings from displaced oil imports; and
- (v) a cost of labour adjustment.

Retail revenues derived from the sale of natural gas represented the major economic benefit of the TransCanada proposal. Revenues were estimated at the distributor level net of any retail sales tax.

A reduction in air pollution and the associated savings in costs were estimated based upon a decrease in the use of fuel oil and a decrease in the anticipated level of refinery activity as natural gas sales displaced fuel oil in Montreal and in the extension market.

The value of an increase in the security of energy supply brought about by its project was estimated by TransCanada to be equal to the maximum damage the Quebec economy could suffer if it were deprived of an equivalent quantity of crude oil. The damage to the Quebec economy was calculated on the probability of a short run and a long run interruption of foreign oil.

The assumed market value of foreign exchange flows was adjusted upward by 13 percent to reflect its estimated economic value in determining the cost of foreign oil displaced by natural gas in Montreal and the extension market. This benefit was anticipated because, even under a flexible exchange rate, the existence of tariffs, export subsidies and indirect taxes was said to create a divergence between the market price and the economic value of foreign exchange.

The cost of labour was estimated to be 90 percent of the total wage bill for 1980 increasing at one percentage point each year until parity with the wage bill was reached in 1990. This adjustment was made because of the historically high rate of unemployment in Quebec. As a result, the opportunity cost of labour was estimated to be lower than the going wage rate. The Applicant considered this labour adjustment to be a benefit.

TCPL included in its analysis costs associated with incremental construction and operations and maintenance of the distribution systems which would be required in Quebec, the proposed transmission system in Quebec, and the upstream TCPL system to the Alberta border. The costs of converting consumers of alternative energy forms to natural gas were also included, as TCPL assumed distributors would pay these costs. All indirect taxes, municipal taxes, and the cost of compression fuel gas were excluded from the analysis.

The study concluded that there would be no appreciable direct economic impact on the refining and distribution industries resulting from the substitution of gas for fuel oil. This conclusion was based upon an assessment of any permanent unemployment caused in distribution and refining activities and any incremental capital costs that might be incurred by the Quebec refiners to adapt their production slates to

changes in markets for their products, where the market changes were exclusively due to the penetration of gas.

The foregone net economic benefits from any alternative use for the gas to be sold in the project area were said by TransCanada to constitute an opportunity cost to be assigned against its proposed pipeline project. TCPL concluded that, in the absence of its proposed pipeline project, the gas could only be used later in Canada since the volumes were set aside for Canadian use in the Board's surplus determination test. Thus, TCPL estimated the benefits and costs associated with marketing the gas in the existing Ontario market between 1993 and 2003. Direct benefits were projected to include retail revenues, savings in pollution costs, the value of increased security of energy supply and a premium adjustment on foreign exchange savings. Direct costs were represented by a cost of service tariff which included transportation costs on TCPL as well as distributors' costs.

On the foregoing basis TCPL estimated the net economic benefits of its proposed pipeline project to Canada to be \$988 million (present value to 1980 in 1979 dollars based on a ten percent rate of discount). Consequently, TCPL concluded that the proposed Quebec pipeline extension was desirable. The results of the TCPL analysis are presented in Table 8-6.

The TCPL study also estimated the present value of the amount its proposed pipeline project could afford to pay for natural gas at the Alberta border. This estimated lump sum payment of \$3.2 billion (1979 dollars) represents the amount which the TransCanada pipeline project in Quebec would be willing to pay to natural gas producers to contract in advance for future delivery of the approximately 3.8 EJ of gas to the Alberta border, as required by the project in the period to the year 2000. This amount, as shown in Table 8-6, is an integral part of the cost-benefit analysis.

#### 8.1.5.2 Views of Intervenors

While Saskatchewan submitted that the viability of the TCPL and Q & M pipeline projects had not been demonstrated based upon its review of the TCPL and Q & M cost-benefit studies, Saskatchewan commented mainly



on the TCPL project. Saskatchewan said that the opportunity cost of gas was understated in the TCPL study.

Saskatchewan submitted that the net economic cost of the TCPL project would be \$500 million (net present value in 1979 at a ten percent discount rate in 1979 dollars) based upon its own adjustments to the TCPL cost-benefit study.

Saskatchewan further recommended that other energy alternatives should be compared with this project before such large sums of capital were invested.

#### 8.1.5.3 Views of the Board

In estimating the benefits of its proposal, TCPL represented the value of the gas by the distributors' retail revenues. In the Board's view, the value of the gas is more accurately represented by the prices, after adjusting for efficiencies, of the energy products displaced plus the value of any government subsidy pertaining to those prices. This approach has been adopted in the Board's analysis.

The Board believes that benefits associated with reduced pollution can be realized from greater use of gas, and that they can be estimated by the saving of costs related to environmental damage. However, the Board notes that the estimates made by TCPL depend on several assumptions involving considerable uncertainty. The Board's estimate of benefits from reduced pollution is based on an estimate of the cost of upgrading heavy fuel oil to meet environmental standards.

The value of security of energy supply afforded by the TCPL proposed pipeline project was estimated by TransCanada to be equal to the economic damage to the Quebec economy which could be caused by a crude oil supply curtailment. It is the Board's view that a more appropriate approximation of the value of security of supply, in the context of cost-benefit analysis, is obtained by estimating the foregone cost of additional oil storage and the Board has adopted this methodology in its analysis.

Under assumptions the Board would view as reasonable, the Board estimated the effect of making adjustments to the cost of labour and found the effect to be negligible.

Table 8-6

SUMMARY OF THE TCPL COST-BENEFIT ANALYSIS FOR  
ITS PROPOSED PIPELINE EXTENSION IN QUEBEC

(Present value, \$1979 millions,  
discounted to 1980 at 10 percent)

	<u>Benefits</u>	<u>Costs</u>	<u>Net Benefits (Costs)</u>
<u>Project Benefits &amp; Costs</u>			
Retail Revenues	4 492		
Allocated Capital Costs*		894	
Operating & Maintenance Costs*		358	
Sub-total**			3 240
Pollution Cost Savings	62		
Security of Supply	401		
Foreign Exchange Adjustment	431		
Cost of Labour Adjustment	14		
Sub-total			908
Total Project Net Benefits			4 148
<u>Foregone Net Benefits of Alternative Use</u>			
(Deferral to 1993)			(3 160)
<u>Net Economic Benefits</u>			
Project vs Alternative			<u>988</u>

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\* Includes costs for the TCPL system upstream to the Alberta border, downstream to Lévis-Lauzon, the associated distribution systems and conversion.

\*\* Estimated amount that the proposed project could afford to pay for gas at the Alberta border.

With regard to the treatment of foreign exchange, the Board does not share TransCanada's view that any estimated difference between the market rate of foreign exchange and its hypothetical value should be reflected in cost-benefit analysis.

In its analysis, TCPL estimated the net economic benefit of its proposal east of the Alberta border. As such, producers' costs and AGTL transportation costs were excluded from the analysis. In the Board's view, these quantifiable resource costs should be included in the analysis since they affect the estimated net economic benefit of the project because the rate at which these costs are incurred differs with the timing of the alternative uses of the gas. The Board has adopted this approach in its analysis.

The capital costs of the TransCanada proposal were allocated by TCPL on the basis of annual depreciation rates and were spread over a period of up to 36 years. The Board notes that the effect of allocating capital costs as described is to understate the costs of the proposal as incurred and, as a result, to overestimate the net benefits. While the Board recognizes that the life of the project may extend beyond 20 years, for the purposes of cost-benefit analysis, costs should be charged against the project on a cash flow basis, as incurred.

In its cost-benefit analysis, TCPL concluded that there would be no appreciable direct economic impact on the refinery industry resulting from its proposal. The Board has assessed the direct impact of the project on the refinery industry in a previous section of the report, and, based upon that analysis and the evidence filed by Hycarb, has included an estimate of the economic loss to the refinery industry in Eastern Canada in its cost-benefit analysis.

In assessing an alternative to using the gas in its proposal, TCPL assumed that initial production of the same gas could be deferred for thirteen years and then all of it could be produced over eleven years for domestic use. It is the Board's view that deliverability cannot be deferred in this manner and that the effect is to overstate the value of this alternative use and, as a result, underestimate the net benefits of the project.

As part of its appraisal of the evidence the Board undertook its own cost-benefit analysis of TransCanada's proposed pipeline project.

The conceptual approach adopted by the Board was to identify first the costs and benefits that would result if the project went forward. The Board then estimated the costs and benefits that would result if the project were not undertaken but the relevant gas volumes were either used at some later date in Canada or were exported (on the same schedule as would apply to the project). The annual net benefits of the project were calculated as the difference between the annual cash flows that would result if the project proceeded, and the annual cash flows that would occur if the gas were used in either of the two alternatives.

The methodology employed is described in detail in technical notes in Appendix 8-B, but generally the approach considers the quantifiable economic benefits and costs from a national perspective. The principal benefits include the economic value associated with displacing imported oil and other energy sources with natural gas, the sale of natural gas by-products, an increase in security of Canadian energy supply, and savings in pollution and oil inventory storage costs.

The principal costs are the costs of construction and operation of transmission and distribution pipelines, conversion of oil burners and other equipment, the costs of producing the gas, and the losses to oil refineries from reduced demand.

As outlined above, the Board's approach leads to two estimates of the net economic benefits of TransCanada's proposed pipeline project.

Against the alternative of exporting the gas at, say, Emerson, Manitoba, the estimated net economic effect of the TCPL project would be a loss of almost \$900 million (net present value at a ten percent discount rate in 1979 dollars). However, the gas to be used by the TCPL project has been set aside for Canadian use by being protected under the Board's surplus tests, as explained in the Board's November 1979 decision relating to the export of other Canadian gas. Notwithstanding this, the estimate is noteworthy because it indicates the scale of pure economic cost to Canada associated with the Quebec pipeline project.



Against the alternative of using the gas at some later date in Canada, the estimated net economic benefits to Canada of the proposed TransCanada pipeline project are some \$2.1 billion (net present value at a ten percent discount rate in 1979 dollars). The Board views this estimate as the relevant guide for decision making, having already dedicated the gas for Canadian use.

Accordingly Table 8-7 below shows each component economic cost and benefit in the estimated net economic benefits. As is the usual Board practice, the calculation is shown at alternative discount rates. The estimated net economic benefits to Canada remain significant over the range of discount rates.

To test the robustness of the Board's estimates, the Board has evaluated the impact on net economic benefits of changes in important parameters. The Board notes that a doubling in real terms of costs from the Alberta border to Lévis-Lauzon, including transmission, distribution, and conversion costs, would reduce estimated net economic benefits to Canada to just under \$900 million. In the event that the demand for natural gas in Quebec is approximated by the Board's "low case" demand forecast, which is on average 17 percent lower than the Board's "medium case" forecast, net economic benefits for the TCPL project are estimated to remain significant at some \$1.7 billion. The Board also notes that a continued escalation of imported oil prices in real terms would increase the estimated net economic benefits of the proposed TCPL project.

The Board also undertook a private cost-benefit analysis to evaluate the private sector profitability of expanding natural gas sales in Quebec based upon the pricing provisions proposed by TCPL. Estimated revenues from the sale of natural gas and by-products and estimated capital and operating costs incurred by the private sector to develop, produce and transport the gas to consumers in the Quebec market, including royalties and taxes, were incorporated in the analysis. The Board found that TransCanada's project, as proposed, would yield positive profits to the private sector, over and above a normal rate of return.

Table 8-7

SUMMARY OF THE BOARD'S ESTIMATES OF ECONOMIC  
COSTS AND BENEFITS OF TRANSCANADA'S PROPOSED PIPELINE PROJECT IN QUEBEC\*  
(Present Value, \$1979 millions, discounted to 1979)

	<u>5 percent</u>	<u>10 percent</u>	<u>15 percent</u>
<u>Project Benefits</u>			
Value of Displaced Energy	6 550	3 621	2 163
Value of By-Products	1 291	714	427
Security of Supply	97	89	75
Oil Storage Cost Saving	111	76	55
Pollution Cost Saving	<u>58</u>	<u>33</u>	<u>20</u>
Sub-total	8 107	4 533	2 740
<u>Project Costs</u>			
Producers**	1 633	851	479
AGTL	70	39	23
TCPL (upstream to Montreal)	534	361	263
Applicants (downstream from Montreal)	482	366	296
Distributors	790	481	315
Conversion	34	23	16
Reduced Refinery Profits	88	42	20
Gas Reserves Adjustment	<u>1 582</u>	<u>246</u>	<u>17</u>
Sub-total	5 213	2 409	1 429
<u>Net Economic Benefits of</u>			
<u>the Project</u>	<u>2 894</u>	<u>2 124</u>	<u>1 311</u>

\* Gas export price of \$4.17 (U.S.) per gigajoule was assumed.

\*\* Includes gas replacement costs to Canadians.

## 8.2 Q & M

### 8.2.1 Macroeconomic Impact

#### 8.2.1.1 Evidence of the Applicant

Q & M did not provide an assessment of the macroeconomic impact of its project on Canada; however, it did provide an assessment of the impact on the affected regions. Q & M estimated that there would be a positive effect on the balance of payments arising from the displacement of imported crude oil. Q & M estimated this effect to be \$7,784 million through 1990 and \$40,025 million through 2000.

#### 8.2.1.2 Views of Intervenors

A number of intervenors indicated that there would be a positive effect on the balance of payments. Nova Scotia indicated that the saving on crude oil displaced in the Maritimes would grow from \$50 million in the first year of the project to \$490 million by the twentieth year. Over the forecast period the positive impact on the balance of payments would amount to \$5,000 million. These figures are in constant 1979 dollars. The Province pointed out that the displacement of oil imports would result in the lessening of downward pressure on the exchange rate.

#### 8.2.1.3 Views of the Board

It is the Board's view that the combined macroeconomic impact of the TransCanada and Q & M pipelines would likely be small and beneficial. The Board's analysis of the impact on the balance of payments as well as on other macroeconomic variables is summarized in a previous section of the report.

### 8.2.2 Regional Social and Economic Impact Assessment

#### 8.2.2.1 Evidence of Q & M

##### Introduction

Q & M submitted a socio-economic impact statement consisting of the Applicant's policies as well as a consultant's report which assessed the direct economic impact and the direct social impact of the proposed transmission and distribution systems on the Provinces of Quebec, New Brunswick and Nova Scotia.

In addition, Q & M provided a provincial economic impact study, prepared by another consultant, which assessed the total (direct plus induced) effects of the proposed transmission and distribution systems on the Provinces of Quebec, New Brunswick, and Nova Scotia.

Q & M Policy Positions

As a general statement, the Applicant affirmed its intention of making every effort towards maximizing the socio-economic benefits of the project to Canada and to the market area in particular. Q & M recognized that, to achieve this goal, it had to remain responsive to the socio-economic problems and needs of the areas traversed by its proposed pipeline.

The Applicant also stated that it was its firm policy to take into consideration information received from, and concerns expressed by, landowners, other individuals, communities and governments likely to be affected by the project and to reflect their concerns, as far as practicable, during design, construction and operation of the proposed transmission system. To this end, Q & M initiated, and indicated its intention to continue, a community information programme. Q & M testified that as many as 130 communities had been contacted to date in Quebec and the Maritimes. The object of such contacts was to let the communities know of the company's plan and, at the same time, obtain feedback from them. During the construction and operations phase, the Applicant stated that the community liaison program should be continued and amplified, to ensure an ongoing dialogue with the communities.

On matters of accommodation for construction workers, the Applicant stated that these workers would be encouraged to use existing commercial facilities for accommodation and meals. The Applicant did add, however, that if the use of local facilities adversely affected other users (such as tourists), the contractors would be contractually obligated to use self-contained camps. Q & M pointed out that its consultants had already worked on the identification of areas where camps could be required.

With respect to making use of local infrastructure, Q & M indicated that it would work closely with the communities during the operations and maintenance phase in order to avoid overtaxing their existing service facilities. For the construction phase, the Applicant indicated that such matters had already been taken into account in the planning of the project. On the use of medical facilities and services,



the Applicant stated, more specifically, that its policy was directed towards minimizing strain on existing health care systems. Emergency health services would be provided within the project and appropriate transportation arrangements would be made to evacuate patients as required. On matters of security, Q & M felt that adequate law enforcement arrangements should be in place for the project and for the communities affected prior to construction. To this end, the Applicant said it would co-operate with the communities and law enforcement agencies to the extent required.

On matters of local business involvement, the Applicant stated that one of its major objectives was to maximize the participation of local businesses in the project insofar as goods and services could be acquired at a competitive price, and insofar as such goods and services met the Applicant's quality requirements and could be made available on time to fit the construction schedule.

To attain the above objective, the Applicant stated its intention of, firstly, ensuring that local businessmen were aware of the opportunities to participate in and benefit from, the construction and operation of the proposed pipeline. Such an information program would alert businessmen to the types of opportunities available and to the means by which they should go about bidding. The nucleus of this information program would consist of the company having purchasing agents in field offices as contact persons, using the local media and maintaining contacts with local agencies representative of business concerns.

Secondly, the Applicant wished to ensure that purchasing policies reflected the special circumstances and needs of local businessmen. For example, during the construction phase, the Applicant indicated that, whenever practicable, contracts would be tendered in units small enough to be within the capability of small firms. Q & M also stated that, whenever possible, it would provide a greater than normal lead time so that bidders would be able to prepare the required documentation.

Thirdly, the Applicant has undertaken the development of a bidder's list of potential local suppliers of goods and services for use in procurement.

Under cross-examination, Q & M pointed out that it had cautioned local businesses not to gear up too strongly for one single construction project but that rather they should aim at the longer, more sustaining, operations phase of the transmission system and/or the longer lasting construction and operation of the distribution systems.

Q & M stated that contractors and sub-contractors would also be subject to the above policies and that the intent of these policies would be contained in its contract documents including, on the part of the Applicant, the further monitoring this would require.

Finally, with respect to the operations phase, the Applicant indicated it would pursue its policy of maximizing local content in business opportunities and would encourage continued input from local business organizations.

With respect to local employment and training, Q & M believed that an efficient manpower delivery system had to be in place to ensure that employment of local residents on the project would be maximized. Q & M added that it would take the lead in convening meetings of all interested parties such as appropriate government agencies, contractors, unions, and local organizations, to organize the development of a manpower delivery system.

The Applicant also stated that the mechanism for providing pre-construction, construction and operation training would be developed and made known to the public. Here again, Q & M indicated it would take the lead to ensure training programmes were in place and pledged it would cooperate fully with provincial agencies, Canada Manpower, contractors and unions who traditionally provide much of this training. On matters of orientation, the Applicant felt an extensive program would not be necessary for the project.

During the construction phase, the Applicant said it intended to give preferential hiring treatment to local residents when qualifications of a local resident and a non-resident were equal. Q & M

stated that local residents seeking employment, though they might lack certain necessary skills, would be encouraged to take advantage of available training opportunities in those skills required for permanent employment on the pipeline. Q & M added that it would, by contractual obligations, ensure that all contractors and sub-contractors operated in compliance with its policies respecting employment and working condition. Such contractual obligations would be monitored to ensure contractors abided by them.

For the operations and maintenance phase, the Applicant intended to give priority to local residents in the filling of all trainee and journeymen positions. Moreover, once it obtained a certificate, the Applicant wished to initiate on-the-job training for operations and maintenance positions. It stated that AGTL could provide trainee positions and suggested that the present AGTL system had the ready capability to take on about 40 technical on-the-job trainees.

Concerning surplus material and equipment from the construction phase, the Applicant said it intended to give local authorities and individuals, within the market area, the "right of first refusal" over surplus material and equipment from the construction phase.

Finally, with respect to the subject of compensation, Q & M's overall philosophy was that a person adversely affected by the construction of the project should be compensated in an equitable manner and that, during the operations phase, this person should not be disadvantaged as a result of any action by the Company.

#### Social Impact

Q & M explained that social impacts resulting from the construction of the transmission and distribution systems would be quite dissimilar. Most of the impacts of the transmission system would be of an immediate and short-lived nature while those of the distribution systems would be less intense but spread over a much longer period.

Looking first at the social impact of the transmission system, Q & M stated that the construction and operation of this system was not expected to alter, to any degree, the way-of-life of residents along the right-of-way.



Q & M did not anticipate any social conflicts arising from the operations phase of the transmission system and, for the construction phase, stated that many potential conflicts had been avoided by careful routing, proper scheduling and any remaining few cases of conflict could be alleviated by information programs designed to respond to specific concerns of the local population. For example, Q & M suggested that special information programs would be very useful to alleviate the concerns of landowners, of agricultural communities, of fishermen concerned with river and stream crossings, of residents of certain areas that might have special environmental concerns, and of urban dwellers who might be concerned over the influence of the project on the value of land.

Q & M indicated that potential short-term conflicts between pipeline crews and local residents could be minimized by proper scheduling and by the use of work camps where local accommodation was limited. While Q & M recognized that all problems could not be totally resolved by scheduling, it added that the effect on communities could be reduced by planning and the prior involvement of affected communities. Q & M further added that the exact sites for construction camps along the Newcastle Lateral (N.B.), in the Tatamagouche area (N.S.), and in the St. Peters area (N.S.) would be selected in consultation with neighbouring communities.

In respect of impact on local social services and facilities, Q & M expected the impact from the operations phase to be minimal while that coming from the construction phase to be limited and of short duration. Q & M explained that this issue had been taken into consideration during the planning stages of the project and, thus, it should not result in any major problems. For example, in terms of medical facilities and services, the Applicant suggested the market area was sufficiently well-endowed with such facilities and services so that the project would not represent a burden for the regions. On the area's policing capabilities, Q & M stated such services should not be strained in any given area as construction would proceed rapidly and crews would be dispersed over wide areas.



In terms of the social impact of the distribution system, the Applicant pointed out that the larger industrial communities had developed attitudes that accept change and disruption with minimal social impact. Q & M added, though, that this level of tolerance was usually reduced as the population and degree of industrialization of a community decreased. In such smaller communities, the drop in tolerance was reinforced by a "fear of the unknown, a concern for safety and a distrust of the economic impact".

Q & M summarized the general attitude of the communities as being positive towards the potential of having natural gas distribution in their industrial parks. The availability of natural gas was equated with an increased industrial potential and a better standard of living for the residents of the communities.

#### Economic Impact

The following expenditures and impacts were presented in the context of the Applicant's export case, which contemplated exports of Canadian gas to the United States at St. Stephen in New Brunswick. Where specified, however, certain results were provided for the non-export case.

Q & M's regional economic impact analysis of the proposed project consisted, in a first step, of estimating the direct provincial expenditures (i.e., those expenditures being made for goods and services produced in the province) resulting from total project expenditures in each province; and, secondly, in estimating the provincial economic impact induced by direct provincial expenditures.

Direct provincial expenditures were determined through interviews with suppliers, producers, labour organizations, professional organizations, contractors, and government departments. The estimates of total economic impact (i.e., direct and induced impact), on the other hand, were derived by applying certain multipliers to direct provincial expenditures.

Adopting a keynesian income model to provide a measure of the economic impact induced by the operation of the income multiplier, the Applicant estimated the multipliers to be 1.60 for Quebec, 1.72 for

New Brunswick, and 1.64 for Nova Scotia. The analysis also included estimates of probable tax flows (personal income tax flows, indirect taxes, and corporate income tax flows) and employment effects associated with the total income impact of the project.

The Applicant recognized, though, that the nature and extent of such effects depended on the degree to which various provincial economies were fully employed, had ready access to additional productive resources, or suffered offsetting impacts related to the displacement of other energy sources. In this study, however, the analysis assumed that sufficient spare capacity existed within the provincial economies to absorb the Q & M project.

It should also be pointed out that, according to the Applicant, the estimates of total economic impact (direct plus induced) represented an "order of magnitude" for the probable economic impact of the proposed projects on the economies of Quebec, New Brunswick, and Nova Scotia. Moreover, the Applicant indicated that such results could not necessarily be viewed as a maximum impact as they did not capture all of the potential impacts. For example, its computations did not capture any "forward effects" resulting from the project (such as attracting investment and migrants), nor did it account for any additional economic activity taking place in the provinces as a result of project expenditures made in non-market area provinces of Canada.

Table 8-8 summarizes project expenditures and the economic impact resulting from the project.

#### Quebec

From Table 8-8, it can be seen that project expenditures for the Quebec section (east of Lévis-Lauzon) of the Q & M project would amount to \$259.6 million over the 1980 to 2000 period. It was inferred that about 66 percent of these expenditures would result in a direct provincial impact. It should be pointed out that Q & M expenditures in Quebec did not include any costs related to distribution. On the employment side, the project would create 1,626 man-years, of which, it was inferred, about 87 percent would accrue to residents of Quebec.

The table also indicates that the project would result, in Quebec, in a total income impact of \$461 million and would generate close to 1,000 man-years of employment every year over the life of the project. Tax receipts accruing to the Government of Quebec were expected to increase by some \$123 million.

In addition to the above, Q & M anticipated that, by the year 2000, an additional \$34 million would be spent on goods and services produced in Quebec and required in the construction of the systems in New Brunswick and Nova Scotia. Similarly, Q & M predicted that close to 400 man-years of employment could accrue to Quebec residents from project-generated activities in the Maritimes.

The Applicant's views on local employment were generally derived from the fact that there existed large-scale unemployment and underemployment in the construction industry in the Province of Quebec and in the Maritimes. In Q & M's view, project requirements should not strain the capacity of the provinces to supply most project manpower requirements. Furthermore, on matters of local and non-local employment, the Applicant stressed that labour imported into Quebec, New Brunswick, and Nova Scotia would be required mainly to fill the highly skilled jobs. In the Maritimes, the Applicant indicated that as many as 70 percent of these jobs could be filled by non-locals, while in Quebec the proportion would vary from 20 to 50 percent depending on the construction season.

#### New Brunswick

Q & M estimated that about \$800 million would be spent in New Brunswick on construction and operation of the transmission and distribution systems from 1980 to 2000. Some 66 percent of these expenditures were estimated to result in a direct provincial impact. On the employment side, it was anticipated the project would create 8,100 man-years of employment, of which, the Applicant expected, 88 percent would be filled by residents of New Brunswick.

For the operations and maintenance phase, Q & M indicated it had planned to establish district offices in Fredericton, St. Leonard, and Sussex. A divisional office had also been planned for Fredericton.



Overall, the project was expected to result in an income increase of some \$820 million in New Brunswick and to generate, on an average annual basis, over 2,000 man-years of employment over the 1980 to 2000 period. The project was also expected to induce an increase of \$163 million in government tax receipts.

#### Nova Scotia

From Table 8-8, it can also be seen that according to the Applicant, total project expenditures in Nova Scotia would amount to \$390 million over the 1980 to 2000 period. Of this amount, it was anticipated that about 71 percent would be spent on goods and services produced in Nova Scotia.

The project was also expected to require about 5,300 man-years of employment of which 95 percent could be filled by residents of Nova Scotia.

For the operations and maintenance phase, Q & M stated that a divisional office would be set up in Truro along with two district offices in the areas of Truro and Port Hawkesbury.

Project expenditures taking place in Nova Scotia were expected to generate an income increase of some \$395 million in the Province over the 1980 to 2000 period and to generate, on average, on an annual basis, slightly more than 1,000 man-years of employment. It was also anticipated that the project would generate an increase of about \$100 million in government tax receipts in the Province.

#### Non-Export Case

In the non-export case, the Applicant indicated that transmission expenditures would decrease by \$182 million up to the year 2000, which corresponded to a decrease in total expenditures, over the three provinces, of some 13 percent.

Q & M stated further that the elimination of exports reduced the estimated income increase generated by the project, in the three provinces, by some 20 percent, while taxes would fall by 25 percent and employment (direct and induced) by 20 percent.



Table 8-8

Q & M ESTIMATE OF THE POTENTIAL PROVINCIAL ECONOMIC  
IMPACT OF THE PROPOSED Q & M PIPELINE PROJECT AND  
ASSOCIATED DISTRIBUTION FACILITIES - 1980-2000  

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(\$1979 millions)

	(1) <u>Quebec</u>	New <u>Brunswick</u>	Nova <u>Scotia</u>	<u>Total</u>
Total Project Expenditures <sup>(2)</sup>	259.6	802.4	390.1	1,452.1
Direct Provincial Expenditures <sup>(2)</sup>	170.5*	529.2	278.7	978.4
Total Project Employment (Man-Years)	1,626	8,091	5,310	15,027
Direct Provincial Employment (Man-Years)	1,415*	7,104	5,067	13,586
Total Income Impact <sup>(3)</sup> (Direct plus Induced)	461	821	395	1,677
Impact on Taxes				
Personal Income	60	52	27	139
Indirect	53	70	47	170
Corporation	<u>10</u>	<u>41</u>	<u>25</u>	<u>76</u>
Total Taxes	123	163	99	385
Average Yearly Total Employment Impact <sup>(4)</sup> (Direct plus Induced) (Man-years)	980	2,076	1,007	4,063

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(1) East of Lévis-Lauzon to New Brunswick border only.

(2) Includes municipal taxes and corporate income taxes (paid by transmission and distribution companies); excludes conversion costs and fuel gas costs for transmission.

(3) Net of labour income of petroleum workers displaced by the proposed project.

(4) Net of petroleum workers displaced.

\* The Applicant did not explicitly provide these figures. They were inferred from Q & M Exhibit 22-108.

#### 8.2.2.2 Views of Intervenors

Earlier in this chapter, the evidence of certain intervenors was described in conjunction with the application of TransCanada. The evidence of those intervenors applied equally to the Q & M pipeline between Lévis/Lauzon and the Quebec/New Brunswick border.

ADEQ said that it would like to see its region, and mainly the Rivière-du-Loup to Matane (and Matapédia) axis, serviced with natural gas. It viewed natural gas as being vitally important to the industrial development of this region. Natural gas, it stated, would provide the region with a comparative advantage in attracting industry, which should contribute to ensuring economic stability to the area.

CRDEQ held views similar to those described above. The Conseil felt that the security of supply associated with natural gas would be an important advantage in attracting industry to the region, particularly in the pulp and paper sector. Another positive aspect of gas was, in its opinion, that it would be less of a pollutant than petroleum. The Conseil also recommended to the Board that the Q & M pipeline project be certificated conditional upon the extension of gas service into eastern Quebec, to Matane and possibly Matapédia.

New Brunswick recommended that the Board delay its decision until more was known about Sable Island and Arctic gas as well as Western and Arctic oil and until the Government of Canada had studied which energy alternatives were in the best interests of New Brunswick. New Brunswick felt that all alternatives should be examined and that there was a need to study the effect of an energy supply change on economic variables such as employment, industrial development, etc. On the other hand, the Province made the following recommendations in case the pipeline were to be certificated at this time: that supplementary hearings be held along the right-of-way to consider land use and environmental concerns; that mitigative measures be compiled for consideration during the above hearings; and that landowners be offered better compensation arrangements.

D.C. MacCharles, a professor at the University of New Brunswick, testified that "boom-bust" cycles had historically been

displayed in the Province and that the proposed project had characteristics capable of contributing to such a situation. In his view, one way of improving on this would be to extend the project construction phase over a longer period. With respect to the evidence presented by the Applicants, Professor MacCharles felt the economic impact of the project on New Brunswick had been overstated. Professor MacCharles was also of the view that redistribution of income, as a result of the project, would be unfavourable to New Brunswick as additional funds would be flowing west (in the form of rents from the purchase of gas) thus increasing regional disparities.

Nova Scotia testified that, in addition to having an immediate and sustained effect on income and employment, the project would contribute to industrial expansion and economic development. With respect to project facilities, Nova Scotia expressed its satisfaction with the commitments made by the Applicant in regard to local hiring and purchasing. Finally, Nova Scotia indicated that it would like to have natural gas reach the Annapolis Valley.

SCIDA supported the construction of a pipeline to carry Western Canadian gas to be sold at prices no greater than those charged at the Toronto city gate. The Authority also wanted this pipeline to have the capability of transmitting (potential) Eastern Canadian gas towards Central Canada and other points. In its view, natural gas, at improved prices, could act as a development tool for the region as well as enhance the viability of existing plants. The Authority said that, at the moment, there did not exist sufficient choice of energy sources in the area. The Authority said that energy costs could substantially influence economic and industrial development because the area's ability to create new employment was dependent on its ability to demonstrate to potential clients that, on balance, plants located in eastern Nova Scotia were not at a disadvantage, energy-wise, compared to locating in other areas.

Finally, the Province of Newfoundland and Labrador pointed out that, if gas service were extended into Quebec and the Maritimes on a subsidized basis, the new market areas could enjoy significant benefits in the form of substantially reduced energy prices. The Province said

that the artificial reduction of energy costs in Quebec and the Maritimes could seriously disadvantage the people and industry of Newfoundland. For example, the Province's basic industries would suffer some loss of competitiveness. The Province stated that, if subsidies were involved in marketing gas in new market areas, it should receive some form of balancing compensation to reduce its energy prices or some form of financial assistance to stimulate the development of hydro-electric power or other renewable energy resources.

#### 8.2.2.3 Views of the Board

The Board notes that, in New Brunswick, the population of major communities along the route of Q & M's proposed mainline would be in excess of 150,000. The Newcastle lateral would reach about 70,000 people and the Saint John lateral about 90,000 people. In Nova Scotia, the mainline would affect a population of over 260,000 and the Sydney/Glace Bay lateral a population of about 125,000.

The Board also takes note of the extensive information and consultation program undertaken by Q & M in the affected areas and believes this program would go a long way towards minimizing social conflicts that might be associated with the project. The Applicant's commitment to pursue this program during the construction phase of the project would help alleviate new problems whether they be at the individual level, in terms of impact on local infrastructure, or in other respects. In addition, the use of construction camps in areas where accommodation facilities and services were not deemed to be sufficient would be very useful in avoiding difficulties.

Nonetheless, the Applicant intends to make use of existing facilities in other areas and the Board believes that summer construction activities could run into conflict with the tourist trade. It is the Board's view that the Applicant must remain responsive to such situations, especially if the needs of workers, in terms of local facilities and infrastructure, added to the needs of tourists, began to have an impact on the level of facilities and services available to local residents.



The Board notes Q & M's policies on local employment and local purchasing and believes that these would afford local residents and businesses ample opportunity to benefit from the project. This could represent a significant positive impact for areas such as the Maritimes where unemployment poses a serious economic problem. Of particular interest should be the ongoing jobs created in both the transmission and distribution systems.

The Applicant indicated that the attitude of communities towards the potential for having gas in their industrial parks was generally positive as the availability of gas was equated with an increased industrial potential and a better standard of living. The Board sees no reason not to agree with this view especially since no intervenors came forth expressing contradictory views, although a few intervenors expressed concern about the impact the project might have on the petroleum refining and distribution sector with its attendant consequences on employment and income.

The Board believes that the Applicant has provided reasonable estimates of the direct provincial expenditures resulting from total expenditures on the project. The Board accepts Q & M's estimates of direct provincial impact. However, the Board believes several problems exist with regard to the provincial income multipliers applied by the Applicant to the above expenditures. While this type of multiplier takes account of the internal structure of the provincial economies, it does not reflect the manner in which the injection of expenditures is distributed across the various sectors of the economy. With such a multiplier, each form of exogenous injection of expenditures is assumed to have the same multiplier effects upon the recipient economy. The results of this approach are thus very broadly-based.

Furthermore, the internal structure of the provincial economies is reduced to its simplest expression in the methodology used by Q & M, and the resulting income multipliers display high sensitivity to minor changes in some of the key coefficients such as the propensities to import and invest.

Overall, the above multiplier approach is less satisfactory than an input-output analysis. Certain further problems exist in the results of the Q & M study. First, the direct provincial expenditures, to which the multipliers are applied, contain estimates of the direct municipal taxes and the provincial share of corporate income taxes (paid by the transmission and distribution companies). While the Board acknowledges that these are direct provincial economic impacts resulting from the project, it is not clear what the indirect and induced effects of these expenditures might be. While additional municipal tax revenues or provincial corporate tax revenues could be reinjected into the provincial economy, it is just as likely that they could serve to reduce the Province's or the municipalities' deficits.

Secondly, some of the impacts, most notably the project employment impact, appear inflated to some degree.

Thirdly, the income multipliers estimated by Q & M for Quebec, New Brunswick and Nova Scotia appear counter-intuitive if examined one against the other. In the Q & M study, the income multipliers for New Brunswick and Nova Scotia are larger than that for Quebec, whereas the higher degree of openness (larger import leakages) of the Maritime economies suggests that the opposite would be true.

Finally, the operation of the income multiplier implies the absence of supply constraints, and, at least with respect to labour resources in the Maritimes, this appears a reasonable assumption.

The Board's own analysis of the provincial economic impact of the Q & M project used the same methodology as described in the section dealing with the TransCanada project except that additional multipliers were developed for New Brunswick and Nova Scotia. These additional multipliers were estimated, however, using a simplifying assumption which involved taking as inputs, for the Maritimes, the same project requirements structure as that used for Quebec. The Board believes, however, that the multipliers are not significantly affected by this assumption and that the results afforded by this method are therefore

reasonable. Its analysis is based on the non-export case and does not include the proposed new exports through St. Stephen. In addition, it should be noted that, in respect of Quebec, the results are only concerned with the section of the mainline extending east of Lévis-Lauzon to the New Brunswick border.

The Board's estimates of regional economic impact address the 1980 to 1990 period rather than 1980 to 2000 for the same reasons as those expressed in the Views of the Board section of the TCPL Regional and Social Impact Assessment.

Over the 1980 to 1990 period, it can be seen from Table 8-9 that the proposed project would result in increases in gross domestic product at factor cost in the order of \$62 million for Quebec, \$245 million for New Brunswick, and \$152 million for Nova Scotia. If municipal and provincial corporate income taxes are added to these estimates, the total economic impact would increase, over the 1980 to 1990 period, to at least \$75 million in Quebec, \$293 million in New Brunswick and \$177 million in Nova Scotia. Also, if any part of the federal corporate income taxes were respent in the Provinces, the economic impact would increase correspondingly.

The total employment impact of the proposed project would involve, up to the year 1990, increases of 1,900 man-years in Quebec, 5,200 in New Brunswick, and 3,800 in Nova Scotia.

In addition, conversion costs, which have not been taken into account in the above analysis, could represent direct expenditures of \$92 million up to the year 1990. In turn, these expenditures could generate upwards of 1,100 man-years of employment in the Maritimes over the same period.

The Board's analysis also shows that Q & M project expenditures, taking place in the rest of Canada, could increase the total employment impact in the Maritime Provinces by some three to four percent. In addition, the Board's calculations show that total project expenditures on the Maritimes section of the project could create, in Ontario and in Quebec, as many as 1.3 and 0.75 times (respectively) the

TABLE 8-9  
NEB ESTIMATE OF THE PROVINCIAL ECONOMIC IMPACT  
OF THE PROPOSED Q & M PIPELINE PROJECT

1980 - 1990

(\$1979 millions)

	Quebec <sup>(1)</sup>	New Brunswick	Nova Scotia	Total Project
Total Project Expenditures <sup>(2)(4)</sup>	74.5	313.6	178.0	566.1
Direct Provincial Expenditures <sup>(3)(4)</sup>	42.8	190.1	117.6	454.2
Total Increase in GDPFC (Direct, Indirect and Induced Effects)	62.5	245.2	151.7	459.4
Direct Municipal Taxes	8.8	34.3	18.0	61.1
Total Corporate Income Taxes <sup>(5)</sup>	14.3	55.8	29.3	99.4
Total Project Manpower Requirements (Man-years)	734	4,678	3,157	8,569
Direct Provincial Manpower <sup>(6)</sup> Requirements (Man-years)	630	4,142	2,984	7,756
Total Employment Impact (Man-years)	1,900	5,231	3,769	10,900

(1) East of Lévis-Lauzon to New Brunswick Border.

(2) Includes the Board's estimates of capital and operating costs for transmission and distribution systems. Excludes conversion costs and fuel gas costs.

(3) Derived from total project expenditures by using the proportions calculated by Q & M in Exhibit 22-108.

(4) Excluding land costs, municipal taxes and corporate income taxes paid by transmission and distribution companies.

(5) Of this total, the provincial share is assumed to be 25 percent from Q & M, p. 5.f-8R, Exhibit 22-9. Total corporate income taxes are "normalized" tax revenues.

(6) Derived from total project manpower requirements by using the proportions calculated by Q & M in Exhibit 22-108.



number of jobs they would generate in the Maritimes. These results would indicate that, although the proposed project would contribute to increasing provincial income and employment in the Maritimes, it can not be concluded that the project would also contribute to reducing regional economic disparities that exist between the Maritime Provinces and Central Canada.

The Board concludes that the project could make substantial contributions to the economies of the provinces affected. These contributions would take the form of increased personal income, increased employment and increased municipal and provincial government revenues. Also, it is the Board's view that the proposed project and the associated distribution facilities could be built without any significant socio-economic disturbances.

### 8.2.3 Refinery Impact

#### 8.2.3.1 Evidence of the Applicant

To address the impact of gas penetration in the Atlantic Region, Q & M adopted the Hycarb study filed by TCPL. The approach utilized by Hycarb to analyse the impact in the Atlantic Region was the same as that employed in its analysis of the Quebec refining industry. The approach is outlined in a previous section (8.1.3) of this report.

Hycarb stated that the refining industry in the Atlantic Provinces could technically accommodate the level of gas penetration specified by Q & M. Consequently, crude rates would be reduced by approximately the reduction in light and heavy fuel oil demands.

Hycarb's base case projections indicated that heavy fuel yields would increase from the 1977 level of 34 percent to 36 percent in 1990 and 39 percent in the year 2000. The corresponding yields in the gas penetration case were 33 percent in 1990 and 36 percent in the year 2000.

Hycarb estimated the effect on the profitability of refining operations by the change in future operating margins relative to 1977. By 1985, operating margins were estimated to improve in both the base case and the gas penetration case relative to the 1977 level, although the improvement was less in the gas penetration case. After 1985, margins were estimated to decline toward the 1977 level in both cases.

Based on Hycarb's assessment of the effect of gas penetration on the profitability of future refinery operations, Q & M estimated in its cost-benefit analysis that reduced profitability in Quebec and the Atlantic Provinces over the period 1980-2000 would have a present value of \$52 million in 1979 dollars. The data provided indicated that the reduction in the Maritimes would be \$15 million.

Hycarb stated that its analysis indicated the marginal economics of hydroskimming operations, and that even under the base projections, "very little positive potential exists to improve the refinery economics because of the small growth rate in petroleum product demand, and the small yield of the higher value products for every incremental barrel of crude processed". Hycarb further stated that since hydroskimming refineries face problems under current operations, "the continuation or modification of such operations would likely be resolved long before the effect of natural gas marketing in the Atlantic Provinces becomes noticeable to the industry".

Although Hycarb foresaw no appreciable job displacement in the refining sector, Q & M stated that employment in petroleum marketing and distribution would be affected. Based on an analysis of the relationship between oil product volume changes and staffing requirements, it estimated that about 1,900 jobs would be displaced by the year 2000 in Quebec, Nova Scotia, and New Brunswick. Most of this displacement would represent new jobs foregone.

#### 8.2.3.2 Views of Intervenors

Gulf stated that gas penetration would not reduce the demand for offshore crude oils into Eastern Canada because crude slates from both domestic and foreign sources were becoming heavier while refineries operated to satisfy light oil demands. The problem of the trend to heavier crude oils could be modified in the late 1980's as the proportion of synthetic oils in domestic supply becomes larger and as Hibernia production becomes available.

Gulf stated that it had been studying the feasibility of making an investment of \$500 million to limit residual yields to 20 percent at its Point Tupper refinery, but no specific plans had been made. Gulf

questioned the conclusion of the Hycarb study, namely, that the existing refinery facilities could accommodate gas penetration, on the basis that it did not take into account the trend to heavier crude oils and assumed a "widespread interplay within different companies to accommodate problem areas".

Gulf indicated that, with rare exception, exports of surplus heavy fuel to the U.S. at this time could not be made on a commercial basis and that the government should negotiate special status for Canadian materials in the United States. Gulf suggested that capacity utilization could be improved by the continuation of the recent practice of processing heavy crude for export.

Texaco stated that the refining industry did not have the flexibility to absorb gas penetration without investment in upgrading facilities, but that it was possible that more economic facilities could be constructed if they were to accommodate both gas penetration and the trend toward heavier crude oils. Texaco was also considering the upgrading of its facilities in anticipation of these trends.

New Brunswick and D.C. MacCharles, a professor at the University of New Brunswick, addressed the negative effect of gas penetration on employment in oil refining and product distribution, but did not estimate how large this effect would be.

#### 8.2.3.3 Views of the Board

Hycarb's analysis indicated that the reduction in light and heavy fuel oil requirements in the Maritimes, as a consequence of gas penetration, would result in approximately the same reduction in crude oil requirements, implying that the industry has the capability to reduce heavy fuel yields.

On the basis of the evidence presented, it is the Board's view that displacement of light and heavy fuel oil could create additional short-term problems for Atlantic refiners currently operating below capacity. The outlook for the Atlantic refining industry is further complicated by uncertainties associated with future feedstock supplies. The possible trend to heavier imported oils would require investment in upgrading, while the possibility of future supplies of light crude from Canada's East Coast would tend to obviate the need for this investment.



Some of these problems could be alleviated by increased heavy fuel exports. In addition, and as indicated in its 1978 Oil Report, the Board believes that refiners with current and anticipated spare capacity, particularly in the Atlantic region, should be encouraged to refine United States or overseas crude to supply product for the U.S. market.

As in the case for Quebec, the Board does not believe that the level of gas penetration forecast would have a significant effect on the expenditures otherwise required by the industry to adjust to changes in product slates and feedstock requirements. However, because gas penetration would reduce the volume of products marketed, the profitability of refining operations would be reduced. The Board has estimated in its cost-benefit analysis that reduced profitability over the period 1980-2000 would have a present value of \$5 million in 1979 dollars.

#### 8.2.4 Canadian Content

##### 8.2.4.1 Evidence of the Applicant

With respect to the importance of Canadian content in its purchasing decisions, Q & M stated that its proposed buying policy was to maximize the net benefit of the project to the market area and Canada subject to competitive price, quality, and delivery requirements. Q & M indicated that, because it let it be known to manufacturers that it considered Canadian content in its purchasing decisions, there would be an incentive for them to maximize their Canadian content. Q & M also indicated that its efforts toward "dividing work into smaller packages" and providing lead time for a large number of firms to bid would tend toward increasing Canadian content.

Data filed by Q & M indicated the Canadian content of its facilities to be 91 percent, based on capital expenditures of \$430 million, in 1979 dollars over the period 1980-1989. These expenditures applied to facilities required for the export case. Q & M stated that the percentage Canadian content achieved would be the same if expenditures made over the period 1990-2000 were taken into account. Q & M provided a breakdown of its total expenditures indicating the Canadian content of materials and installation by major expenditure categories. Q & M's estimate is summarized in Table 8-10.



Table 8-10  
Q & M ESTIMATE OF CANADIAN CONTENT<sup>(1)</sup>

	<u>Expenditures (\$1979 Millions)</u>			<u>Percentage</u>
	<u>Total</u>	<u>Canadian Content</u>	<u>Non-Canadian Content</u>	<u>Canadian Content</u>
<u>Land &amp; Land Rights</u>	7.8	7.8	-	100
<u>Pipeline</u>				
- Materials	97.8	89.1	8.7	91
- Installation	<u>173.9</u>	<u>155.9</u>	<u>18.0</u>	<u>90</u>
- Total	271.7	245.0	26.7	90
<u>Compressor Stations</u>				
- Materials	22.2	18.7	3.5	84
- Installation	<u>10.0</u>	<u>9.5</u>	<u>.5</u>	<u>95</u>
- Total	32.2	28.2	4.0	88
<u>Peak-Shaving Facilities</u>				
- Materials	15.0	12.6	2.4	84
- Installation	<u>19.4</u>	<u>18.7</u>	<u>.7</u>	<u>96</u>
- Total	34.4	31.3	3.1	91
<u>Metering Stations and O &amp; M<sup>(2)</sup></u>				
- Materials	10.7	8.6	2.1	80
- Installation	<u>2.9</u>	<u>2.8</u>	<u>.1</u>	<u>97</u>
- Total	<u>13.6</u>	<u>11.4</u>	<u>2.2</u>	<u>84</u>
Total Direct Costs	359.7	323.7	36.0	90
Indirect Costs <sup>(3)</sup>	<u>70.1</u>	<u>68.2</u>	<u>1.9</u>	<u>97</u>
Total Costs	429.8	391.9	37.9	91

(1) Based on Exhibit 22-146. Expenditures required in the export case over the period 1980-1989.

(2) Operation and Maintenance Facilities.

(3) Includes Engineering, Project Management and Contingencies.

Q & M stated that there could be a large variation in the Canadian content of compression equipment, depending on the supplier chosen. Reciprocating gas engine units, which would be used in the underground storage peak-shaving facility as well as in the mainline compressor stations, were estimated to have a Canadian content of 60 percent with estimates from probable bidders in the range of 10 to 63 percent. Compression equipment accounted for the major portion of the non-Canadian content in these facilities.

Q & M stated that project management, engineering and construction, including the design and construction of the peak-shaving facility, would be handled by its own staff or by Canadian consultants.

#### 8.2.4.2 Views of the Board

The Board is satisfied with the approach taken by Q & M to estimate Canadian content and finds its estimate to be reasonable. However, the Board notes that the Canadian content and any industrial benefits actually realized could be lower for the same reasons as stated in the case of TCPL.

If a certificate was granted to Q & M, the Board would require Q & M to file a report with the Board, within 12 months after leave to open had been granted, indicating:

- (i) for each cost category in Table I of Exhibit 22-146, the percentage Canadian content achieved in comparison to the percentage estimates that could be calculated from the data submitted for Q & M, and the reasons for these variations; and,
- (ii) in respect of the expenditures on line pipe, compression equipment, valves and fittings, a statement setting forth the names of Canadian firms invited to make contractual bids and the names of the firms to which contracts were awarded.

### 8.2.5 Cost-Benefit Analysis

#### 8.2.5.1 Evidence of the Applicant

The Q & M cost-benefit study estimated the net economic benefits to Canada of expanding natural gas sales in both Quebec and the Maritimes by evaluating the proposed TransCanada and Q & M pipeline projects on a combined basis as compared to two alternatives:

- (i) exporting the gas to the United States beginning in 1981; and,
- (ii) deferring production to meet domestic requirements beginning in 1993.

The combined projects were assessed by Q & M with and without the proposed export component.

Net economic benefits were estimated separately by Q & M for the following components:

- (i) facilities downstream of Montreal;
- (ii) impact on energy markets downstream of Montreal;
- (iii) the valuation of gas in proposed new Eastern Canadian markets, the upstream facilities and the gas production sector; and
- (iv) alternative uses of the gas.

The separate net benefits for these components were then summed to derive the overall net economic benefits of the combined projects. The period of analysis covered 21 years.

#### Downstream Facilities Component

With respect to the facilities downstream of Montreal, the costs and benefits were assessed first from a private perspective and then were adjusted to a social basis. Direct benefits were represented by

- (i) the revenues of the transmission and distribution systems;
- (ii) adjustments for income taxes; and
- (iii) an adjustment concerning a premium on foreign exchange flows.

The estimated private revenues before income tax were based upon the projected pipeline tariffs for all gas carried by the proposed TransCanada and Q & M pipelines and related distribution systems. Income taxes were added back to private revenues. Revenues in the year 2000 were adjusted upward to accommodate the repayment of and return on undepreciated investment after the end of the period of analysis.

The assumed market value of foreign exchange flows was adjusted upward by 13 percent to reflect its estimated economic value in terms of domestic currency. This shadow price adjustment was applied to the value of imports of goods and services and was deducted from gross benefits.

The direct costs pertaining to the downstream facilities included:

- (i) the capital and operating costs of the transmission and distribution systems;
- (ii) adjustments for taxes; and
- (iii) an adjustment to the cost of labour to reflect its economic value.

Construction and operating costs, including direct and indirect taxes, were estimated from a private perspective for the combined pipelines and related distribution facilities. Duties on imported goods and services were deducted from private costs. Interest payments and dividends within Canada were eliminated from costs. Sales taxes on domestically produced goods and services were treated as economic costs, as it was assumed that these goods and services would be diverted from alternative uses.

One half of the estimated municipal taxes was treated as a user charge; effectively this portion of the tax was assumed to represent a net real resource demand by the combined projects. Q & M considered this an arbitrary adjustment, although the level of municipal taxes was noted to be more closely related to the direct provision of municipal services.

The private cost of labour utilized by the combined projects was adjusted by Q & M because it felt that the market wage did not represent the economic cost of labour. The economic cost of labour was estimated by its opportunity value in various foregone alternatives (employment elsewhere, voluntary unemployment and involuntary unemployment). This comprehensive approach required a broad range of assumptions as to alternative employment prospects. The analysis concluded that the opportunity cost of labour was 62 percent of the total wage bill.



The net benefit of the downstream facilities component of the total project, as estimated, is shown in Table 8-11.

#### Impact on Energy Markets Component

The Q & M study concluded that gas penetration would cause a direct displacement impact in Eastern Canadian energy markets. This impact was treated in terms of:

- (i) reduced refinery profitability;
- (ii) effects on petroleum product marketing and distribution systems;
- (iii) effects on the electric power industry;
- (iv) reduced pollution costs;
- (v) reduced oil storage costs; and
- (vi) an adjustment concerning foreign exchange flows.

The displacement of petroleum products by gas penetration was expected by Q & M to result in an overall reduction in profitability in the refining industry in Eastern Canada. This net loss in profitability represented a direct cost to the refining industry and was charged against the combined projects in the cost-benefit analysis.

With respect to the petroleum product distribution and marketing sectors, the Q & M study concluded that there would be no appreciable direct economic cost as a result of the combined projects although adjustments to the value of labour were required to account for induced unemployment in these sectors.

The displacement of electricity by the combined projects was not expected to produce a significant variation in power generation profits since a close relationship was assumed between the costs of incremental generation and the associated revenues. The marginal source of reduced electric power generation in Nova Scotia and New Brunswick was expected to be oil-fired facilities. However, the associated direct benefits of displacing heavy oil were estimated to be marginal and, therefore, were excluded from the results of the analysis.

Q & M expected that the marketing of natural gas in Eastern Canada would afford savings in pollution costs which would have otherwise been incurred through the continued use of fuel oil. The value of such

benefits was approximated by the incremental cost of using heavy fuel oil with a lower sulphur content.

The reduction in oil demand resulting from gas penetration was expected to decrease the amount of oil inventory required for refinery operations. The associated savings in storage costs were treated as a benefit by Q & M.

The decrease in oil imports directly related to the combined projects resulted in foreign exchange savings which were adjusted upward by 13 percent. The amount of this adjustment was included by the Applicant as a direct benefit.

The net benefit of the overall impact on energy markets is summarized in Table 8-11.

Economic Value of Gas, Upstream Facilities,  
and the Gas Production Sector

In order to evaluate the net benefits accruing to the gas producing sector and the provincial and federal governments, the Applicant estimated the economic value of natural gas and, then, deducted all applicable costs. These comprised gas transmission costs, gas production costs and any other identifiable costs.

The economic value of the natural gas consumed domestically was represented by the domestic price of fuel oil displaced plus the value of the government oil subsidy payments (i.e., import compensation payments) saved by Canada. For the export component of the project, natural gas was valued at a forecast Canadian border price.

Q & M treated pricing incentives to allow and maintain gas penetration as an economic cost in its analysis. Lower prices were considered necessary to attract consumers and act as an inducement offsetting any cost incurred by the consumer, such as conversion costs related to premature retirement of equipment dedicated to another fuel.

The distribution and downstream transmission costs were represented by an average cost of service tariff.

An incremental cost of service required to carry gas volumes dedicated to the combined projects was calculated for the upstream TCPL system. The incremental cost of service was based upon those costs

associated with the combined projects in relation to a base case which excluded the TCPL and Q & M pipeline proposals. Income taxes and sales taxes were excluded as cost items from the analysis.

Q & M based the cost of transporting gas on the AGTL system upon an AGTL forecast of its cost of service. This forecast did not contain specific incremental costs related to the combined projects volumes.

Incremental capital and operating costs pertaining to the development, gathering and processing of natural gas associated with the combined TCPL and Q & M pipeline projects were estimated for the period of analysis. Q & M assumed that 15 percent of the above capital expenditure and 100 percent of exploration costs were incurred prior to 1980 and, thus, constituted sunk costs.

A shadow price adjustment concerning foreign exchange flows was applied to the value of natural gas exports and resulted in an additional benefit of the combined projects.

The net benefit of this component of the combined proposals is presented in Table 8-11.

#### Alternative Uses of the Gas Component

Since absorption of gas by the combined TCPL and Q & M pipeline projects would preclude its use in other markets, the foregone net benefits from alternative uses were considered by Q & M to be a further cost of the gas dedicated to the combined projects. The following two alternative uses were evaluated.

- (i) exporting the gas stream at traditional export points beginning in 1981 at the same level of production as for the combined projects; and,
- (ii) deferring gas production to meet domestic requirements at the same rate of production as for the combined projects in traditional markets beginning in 1993.

For the export alternative, the direct benefits were represented by a forecast export value of the gas and an adjustment to foreign exchange earnings to reflect its economic value. Direct costs

included an incremental TCPL "export" cost of service, the AGTL tariff and the producers costs. For the domestic market alternative, the direct benefits included the value of displaced energy and an adjustment concerning a premium on foreign exchange savings on imported oil to reflect its economic value. Direct costs included a TCPL tariff, an AGTL tariff and producers' costs.

#### Conclusions by Q & M

Q & M estimated the net economic cost (i.e., loss) to Canada associated with the combined TransCanada and Q & M pipeline projects for the non-export case to be \$2.8 billion (present value to 1978 in 1979 dollars based on a ten percent rate of discount) as compared with the alternative of exporting the gas to the United States beginning in 1981. When the combined projects for the non-export case were compared with the alternative of deferring gas production to meet domestic requirements beginning in 1993, Q & M estimated the net economic benefits for the combined projects to be \$456 million.

When the proposed export component was included with the combined TCPL and Q & M pipeline projects, the net economic cost increased to \$3.5 billion, as compared with the alternative of exporting the gas at Emerson. On the other hand, the forecast net economic benefits of the combined projects increased to \$2.3 billion if the alternative considered was deferring gas production for use in domestic markets some thirteen years later. The results of the Q & M analysis are presented in Table 8-11.

Q & M regarded the estimated net economic cost of the combined projects (as compared to exporting the gas) as indicative of the value of non-quantifiable benefits of the combined projects such as: additional security of energy supply; more diversity of consumer energy choices in Eastern Canada; any reduction in regional disparities; earlier development of markets and facilities for the marketing of new offshore sources of Canadian gas; and, other broader difficult-to-quantify benefits of a socio-political nature.



## SUMMARY OF THE Q &amp; M COST-BENEFIT ANALYSIS OF THE COMBINED

## TRANSCANADA AND Q &amp; M PIPELINE PROJECTS

(Present Value, \$1979 millions discounted to 1978 at 10 percent)

	Non-Export Case			Export Case		
	Benefits	Costs	Net Benefits (Costs)	Benefits	Costs	Net Benefits (Costs)
<b>A. Downstream Facilities</b>						
1. Private Revenues	1441			1607		
2. Private Costs		1646			1803	
3. Adjustments						
Income Taxes	103			112		
Foreign Exchange	(6)			(7)		
Labour		(257)			(280)	
Municipal Tax		(54)			(60)	
Import		(6)			(7)	
Net Benefits			209			256
<b>B. Impact on Energy Markets</b>						
1. Reduced Refinery Profitability		52			52	
2. Economic Cost of Displaced Jobs		123			123	
3. Reduced Pollution Costs	101			101		
4. Reduced Oil Storage Costs	119			119		
5. Foreign Exchange Adjustment	724			724		
Net Benefits			769			769
<b>C. Net Benefits of Gas Production</b>						
1. Economic Value of Gas	2442			4038		
2. Foreign Exchange Adjustment	-			329		
Net Benefits			2442			4367
<b>D. Foregone Net Benefits of Alternative Uses</b>						
1. Export All Gas						
(a) Gas Producing Sector		5326			7651	
(b) Foreign Exchange Adjustment		857			1208	
Foregone Net Benefits			(6183)			(8859)
2. Deferral for Domestic Use						
(a) Gas Producing Sector		1694			2684	
(b) Foreign Exchange Adjustment		292			425	
Foregone Net Benefits			(1986)			(3109)
<b>E. NET ECONOMIC BENEFIT</b>						
Combined Projects vs. Export Alternative			(2763)			(3467)
Combined Projects vs. Deferral Alternative			456			2283

#### 8.2.5.2 Views of Intervenors

##### Nova Scotia

Nova Scotia undertook a national cost benefit study based on the premise that the major objective for building the proposed pipeline was to achieve energy self-sufficiency. The analysis considered only the Maritimes and assumed a project life of 20 years. Most of the data used in the study were from the original TCPL application for a pipeline from Montreal to Halifax. The benefits of the project were represented by the displaced volume of crude oil valued at the world price landed at Halifax. On the cost side, incremental production, transmission, distribution and conversion costs were taken into account. The opportunity cost of the gas was estimated at zero because the export market was not considered a reasonable alternative as the gas had already been set aside for future Canadian use by the Board.

The analysis indicated a net economic benefit of \$385 million (net present value at a ten percent discount rate in 1979 dollars).

Nova Scotia also discussed indirect benefits arising from the project. These were: increased energy self-sufficiency for Canada, reduced transfer payments to the Maritimes, positive effects on Canada's balance of payments, and diversification of energy supplies in the Maritimes. The latter would increase consumer choice and inter-fuel competition. None of these indirect benefits, however, was quantified.

##### Saskatchewan

The Province of Saskatchewan submitted that the viability of the Q & M pipeline project had not been demonstrated based upon its review of the Q & M cost-benefit study.

#### 8.2.5.3 Views of the Board

Concerning the transmission companies' costs directly associated with moving the volumes of the combined TransCanada and Q & M pipeline projects, Q & M based the TCPL upstream costs on an incremental cost of service tariff as adjusted for taxes. The AGTL costs were based on an average cost of service tariff. In the Board's view, it would be more appropriate to use cost estimates that exclude financial, tax and rate of return components incorporated in a tariff.

In assessing the cost of labour employed on the combined projects, Q & M estimated the opportunity cost of labour in various foregone alternatives. This approach required a large number of detailed assumptions for which the Applicant provided little supporting evidence. The Board recognizes the complexities inherent in forecasting employment opportunities in the absence of the combined projects and, for this reason, has adopted a simpler approach in dealing with the opportunity cost of labour in its analysis. In the Board's analysis, the effect on net benefits of this adjustment was negligible.

In assessing one of the alternatives to using the gas in the combined TCPL and Q & M pipeline projects, Q & M assumed that gas production could be deferred for thirteen years and then used domestically at essentially the same rate over the next twenty years. The Board notes that, while gas could be delivered as described from specific reserves if they could be set aside, the Board prefers to use an end of the period adjustment, combined with an accounting for lower gas replacement costs if production is delayed, for assessing this alternative use of the gas in its cost-benefit analysis.

Q & M assumed that all combined projects volumes shipped to the year 2000 would be from gas reserves which are already discovered. In the Board's view it is more reasonable to assume that much of the gas will come from future discoveries and that any volumes shipped from Canada's inventory of previously discovered gas will, by the year 2000, have been replaced by new discoveries. For this reason, the Board has adopted in its analysis a long-run average cost approach in estimating the cost of the gas which takes into account estimated future Canadian exploration, development and operating costs.

With regard to the treatment of foreign exchange, Q & M adopted the same approach as TCPL. The Board's views on this matter are expressed in the TCPL section of the report.

Q & M considered one-half of the estimated municipal taxes to be a direct cost of the combined projects. The Board agrees with the Applicant that this constitutes an arbitrary adjustment since no evidence was adduced by the Applicant to support its position. The Board has

excluded any portion of municipal taxes as a direct cost in its analysis.

Q & M's estimate of reduced profitability in the refining industry relied on a study by Hycarb. This study is discussed in a previous section of this report. In its analysis the Board has relied upon some of the data and assumptions provided by Hycarb, but has used its own assumptions on crude costs, refinery-gate prices, and savings in refinery fuel, which are described in Appendix 8-C.

The Board accepts that there would be a saving in crude oil and petroleum product storage costs resulting from gas penetration, especially in view of the rising cost of holding inventories. Although the Board's view is that the number of days of "inventory support" maintained by refiners is somewhat higher than estimated by Q & M, particularly in the Maritimes, it has used the Q & M estimate of 75 days. The inventory savings have been valued using the Board's higher oil costs.

The Board agrees, in principle, that benefits from reduced pollution can be derived from the substitution of gas for heavy oil, and that the cost of upgrading heavy fuel oil to meet environmental standards is one way of estimating this benefit. The Board has adopted the Applicant's approach in this matter.

As described in the section of the report on the views of the Board on TransCanada, the Board has performed a cost-benefit analysis to evaluate the TransCanada portion of the combined projects. The Board also evaluated the combined TransCanada and Q & M projects, as did Q & M. By comparing the estimated net economic benefits of the combined projects with those estimated for the portion in Quebec, this approach permits the Board to estimate the incremental net economic benefits of extending the project east of Lévis-Lauzon to Halifax. The Board, however, did not include the proposed exports through St. Stephen in its cost-benefit analysis.

The Board's conceptual approach to cost-benefit analysis is outlined in the TransCanada section, and like that of Q & M it leads to two estimates of net economic benefits depending on the alternative considered for the gas.



Against the alternative of exporting the gas, the estimated net economic effect of the Q & M project would be a loss of some \$520 million (net present value at a ten percent discount rate in 1979 dollars).

Against the alternative of using the gas at some later date in Canada, the estimated net economic benefits of the proposed Q & M pipeline are some \$680 million (net present value at a ten percent discount rate in 1979 dollars). Table 8-12 below shows the composition of the estimate, at alternative discount rates.

This estimated net economic benefit of some \$680 million, while positive and significant, is one-third the Board's estimate for the proposed TransCanada pipeline project in Quebec. However, the Board's estimate of net economic benefit per cubic metre of gas delivered to market is approximately the same for both pipelines. The major reason for this result is that the Board's estimate of average distributors' costs per cubic metre delivered is substantially lower for the Q & M project than for the TransCanada project in Quebec.

The estimated gas volumes for the Q & M project are some one-third of those for the project in Quebec, although the mainline capital costs are about the same. This suggests that in the Maritimes, although distribution costs per cubic metre are estimated to be lower than in Quebec, the net economic benefits of the Q & M project, as estimated by the Board, are very sensitive to any cost overruns which might occur on the mainline.

The robustness of the Board's estimates has been assessed by evaluating the impact on net economic benefits of changes in important parameters. The Board notes that a doubling of incremental transmission, distribution and conversion costs would reduce the estimated net economic benefits of Q & M to zero, whereas, under such conditions, the net economic benefits in Quebec would remain substantial. In the event that the demand for natural gas in the Maritimes is approximated by the Board's "low case" demand forecast (on average 10 percent lower than the Board's "medium" forecast), net economic benefits for the Q & M project are estimated to be reduced to some \$580 million. Finally, the Board

Table 8-12  
SUMMARY OF THE BOARD'S ESTIMATES OF ECONOMIC  
COSTS AND BENEFITS OF THE GAS EXPANSION PROJECT

BEYOND LEVIS/LAUZON\*

(Present Value, \$1979 millions, discounted to 1979)

	<u>5 Percent</u>	<u>10 Percent</u>	<u>15 Percent</u>
<u>Project Benefits</u>			
Value of Displaced Energy	2 352	1 393	892
Value of By-Products	461	275	177
Security of Supply	37	37	33
Oil Storage Cost Saving	38	29	24
Pollution Cost Saving	<u>23</u>	<u>14</u>	<u>9</u>
Sub-Total	2 911	1 748	1 135
<u>Project Costs</u>			
Producers**	520	284	167
AGTL	25	14	10
TCPL (upstream to Montreal)	156	123	102
Applicants (downstream from Montreal)	456	340	270
Distributors	236	161	117
Conversion	84	60	45
Reduced Refinery Profits	-5	5	7
Gas Reserves Adjustment	<u>525</u>	<u>82</u>	<u>6</u>
Sub-total	1 997	1 069	724
<u>Net Economic Benefits of the Project</u>	<u>914</u>	<u>679</u>	<u>411</u>

\* Gas export price of \$4.17 (U.S.) per gigajoule was assumed.

\*\* Includes gas replacement costs.

notes that a continued escalation of imported oil prices in real terms would increase the estimated net economic benefits of the proposed project.

Stated briefly, the economic benefits of the proposed Q & M pipeline appear both smaller and less certain than the proposed TransCanada pipeline, but the Board notes, even more emphatically than in considering the project in Quebec, that future increases in imported oil prices will lead to increased economic benefits associated with the Q & M project.

The Board also undertook a private cost-benefit analysis to evaluate the private sector profitability of expanding natural gas sales in Quebec and in the Maritimes based upon the pricing provisions proposed by the Applicants. Estimated revenues from the sale of natural gas and by-products and estimated capital and operating costs incurred by the private sector to develop, produce and transport the gas to consumers in the Quebec and Maritimes markets, including royalties and taxes, were incorporated in the analysis. A similar private economic evaluation was carried out by Q & M, but only for that component of the combined projects downstream of Montreal.

The Board found that both the combined TCPL and Q & M projects and the TCPL project in Quebec, as proposed, would yield positive profits to the private sector, over and above a normal rate of return. However, the Q & M project, when considered incrementally east of Lévis-Lauzon to Halifax, showed an approximate break-even situation.





TECHNICAL NOTE ON THE BOARD'S REGIONAL ECONOMIC IMPACT ANALYSIS

The general assumptions and methodology underlying the Board's regional economic impact analysis are discussed in the following paragraphs.

The Model

The Board's estimates are derived using the Statistics Canada Regional Input-Output model. A summary of this model is presented at the beginning of section 8.1.2.3 of the Report. This model uses 1966 technological link coefficients which, while they may not be as up-to-date as might be desired, are viewed as reasonable for the Board's purposes because such coefficients are generally known to change only gradually. In addition, an important consideration in choosing this model is that it affords the possibility of gauging some of the interregional effects associated with the proposed project, which effects can be very significant.

Input Structure - TCPL Project

The inputs and the input structure used to generate results from the model cover the period 1980 to 1990. With regard to the Canadian and provincial expenditure estimates, the Board's approach generally agreed with the Q&M estimates.

Input Structure - Q & M Project

In order to calculate the economic impact in the Maritime Provinces, a simplifying assumption is made which consists of deriving the multipliers using the same Total Canada-provincial expenditure ratios as well as the same Canadian and provincial breakdown of expenditures as that used in the Quebec study. The Board believes, however, that the multipliers are not significantly affected by this assumption and that the results afforded by this method are therefore reasonable.

### National Industries

The impact on regional output produced by the model is slightly understated due to the presence of national industries. Wholesale trade and most transportation industries are not provincialized. Any increase in these activities will not show up in the provincial totals. To correct for this understatement, it is assumed that the additional output of these national industries would be distributed among the regions in the same proportion as the model allocated wages and salaries.

### The GDPFC Measure

The model does not automatically calculate the change in GDPFC resulting from provincial project expenditures. To calculate the Gross Domestic Product at Factor Cost, for Quebec and the Maritimes, it is necessary to assume that the ratio of wages, salaries, supplementary income and net income of unincorporated business to GDPFC in each region is the same for the regions as for Canada.

TECHNICAL NOTES ON THE BOARD'S COST-BENEFIT ANALYSIS (TRANSCANADA)

The general assumptions underlying the Board's cost-benefit work are discussed in the following paragraphs. The Board has relied upon evidence obtained during the hearing, which has been supplemented, where necessary, by its own knowledge of the gas production and transmission industry.

1. Producers' Costs- Over the period 1980 to 2000, many factors will have an impact on the average annual cost to Canadians of natural gas. In particular, currently connected depleting gas fields will have to be replaced with higher cost conventional supplies and eventually with frontier supplies. For this reason the Board has estimated capital and operating costs based on a long-run replacement cost approach which takes into account the full cost of finding, developing and operating future Canadian gas supplies.

Based on the Board's estimates of future annual gas deliverability and requirements, estimates were made of the average annual real resource costs of finding and developing gas in Canada. Exploration activity and subsequent costs were assumed to continue at 1978 levels, but reserves additions were projected at a level that resulted in frontier gas being needed in Canada in the mid-1990's. Thus, implicitly, finding costs per unit were assumed to increase. However, development costs per unit were assumed to remain constant in real terms on the basis that technological advance would offset any tendency for real costs to increase as a result of more difficult or deeper drilling. The resultant pattern of real resource costs per unit was then approximated by a smooth exponential curve to yield an average rate of increase in costs per unit produced in the future.

The Board is aware of the uncertainties inherent in forecasting future finding and production costs. Nevertheless, the Board estimates that real replacement costs may rise approximately one percent per 1 055 PJ of gas produced, rising from \$0.59/GJ in 1980 (1979 constant dollars) to approximately \$1.32/GJ in 2000. The cost-benefit results are based upon these cost estimates.

2. Gas Replacement Costs - For purposes of this analysis, the Board in its cost-benefit study considered the increased cost to Canadians of having to use higher cost gas sooner than would be the case without eastern market expansion or without other early uses of the gas. In estimating these replacement costs, the Board examined the difference between the real unit costs associated with increasing gas supplies by the amount required to supply either the TCPL project or the TCPL and Q & M projects and those unit costs estimated without eastern market expansion.
3. Gas Reserves Adjustment - For purposes of this analysis, while gas replacement costs accounted for the increased cost to Canadians of using higher cost gas sooner as a result of eastern market expansion, it is the Board's view that an additional cost to Canadians of supplying natural gas to either the TCPL project or the TCPL and Q & M projects is the foregone net benefit associated with retaining the gas for later use.

The Board estimated the value to Canadians of natural gas reserves in the year 2000 to be \$0.68/GJ based on a real discount rate of ten percent and an export border price of \$4.17 (U.S.) per GJ. The social value of natural gas was arrived at by undertaking a discounted cash flow analysis of the estimated annual revenues and resource costs which would result from producing natural gas reserves available in the year 2000 over the ensuing years.

4. Refinery Impact - Q & M estimated the present value of the reduction in profitability (or foregone economic rents) of refining operations as a result of gas penetration. Q & M's analysis applied to Quebec and the Maritimes, in total, and relied on the results of the Hycarb simulations of refining operations in Quebec and the Maritimes.

The Board has adopted the general approach used by Q & M and Hycarb but has employed its own lower forecast of product displacement and assumptions on crude costs, savings in refinery fuel and refinery gate prices. The approach requires:



- (i) estimation of the change in light fuel oil and heavy fuel oil revenues at the refinery-gate brought about by the project assuming that fuel oil product prices and revenues from other products remain unchanged; and
- (ii) estimation of the change in feedstock costs resulting from lower fuel oil demand and savings in refinery fuel.

Changes in crude oil costs represent volume and quality (as measured by API gravity) changes. The calculations in respect to change in crude quality are based on data provided in Hycarb's analysis. The change in profitability is calculated as the difference between (a) the reduction in product revenues and (b) the savings in feedstock costs. The Board estimates that the reduction in profitability in the industry in Quebec over the period to the year 2000 would have a present value of \$42 million in 1979 dollars. The assumptions on product displacement, refinery gate prices and savings in crude costs are contained in Table 8-13.

Table 8-13

SUMMARY OF BOARD'S ASSUMPTIONS REGARDING  
REFINERY IMPACT IN QUEBEC

	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
<u>Product Displacement</u> <sup>(1)</sup> - m <sup>3</sup> /d				
Light Fuel Oil	922	2 353	3 402	3 832
Heavy Fuel Oil	<u>3 386</u>	<u>5 946</u>	<u>7 472</u>	<u>9 173</u>
Total	4 308	8 299	10 874	13 005
<u>Reduction in Refinery Fuel</u> <sup>(2)</sup>				
- m <sup>3</sup> /d	258	498	652	680
<u>Refinery Gate Prices</u> <sup>(3)</sup> - \$/m <sup>3</sup>				
Light Fuel Oil	194.80	194.80	194.80	194.80
Heavy Fuel Oil	166.99	166.99	167.44	167.56
<u>Reduction in Crude Costs</u> <sup>(4)</sup>				
- \$/m <sup>3</sup>	168.44	155.30	163.10	164.16

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(1) Board's estimate.

(2) Board's estimate. Fuel savings are assumed equivalent to 6 percent of product displacement.

(3) Based on Exhibits 22-145 and 23-182 and the Board's estimated average crude cost of \$179.20/m<sup>3</sup> in 1979 dollars. Heavy fuel oil prices are a weighted average of low sulphur and high sulphur heavy fuel oils.

(4) Based on Exhibits 23-21 and 23-186 and adjusted for Board's average crude costs. See note on the following page.

Notes to Table 8-13

Savings in Crude Costs

Savings in crude costs are calculated on the basis of Hycarb's assumptions about crude oil mix. Gas expansion would require refiners to process a lighter mix of crude to reduce the yield of heavy fuel oil while meeting the requirements for lighter products not affected by gas expansion. The assumptions on quality differentials were applied to the Board's estimate of the average price of \$179.20/m<sup>3</sup> in 1979 dollars. When the volume of crude oil sales is reduced as a result of the project, the cost saving in crude is not simply the average cost of crude multiplied by the volume reduction because gas expansion requires that heavy fuel oil production be decreased (and also, some light fuel oil) while meeting demands for other products. A larger percentage of higher quality lighter crude would have to be run, because no investments are assumed for upgrading of refineries. In 1985, for example, the Quebec refiners' average cost per barrel of crude would be \$179.20/m<sup>3</sup> (in 1979 dollars) while the cost reduction for the marginal cubic metre is \$168.44.

5. Security of Supply

The Board has estimated a security of supply benefit which can be imputed to the project on the basis that it would reduce the amount of oil imports subject to a supply curtailment. In order to make this estimate, assumptions are necessary with respect to the least cost alternative of providing security and the length of period over which "protection" should be provided. The Board has assumed that the alternative method of providing security of supply would be by storage of crude oil in salt caverns in Atlantic Canada, for example, at the Strait of Canso.

The value of security of supply offered by the gas pipeline is taken to be equal to the cost of storing a quantity of oil which is an energy equivalent to a 90-day throughput of gas.

Based on information provided at previous hearings on the capital and operating costs of salt cavern storage, the Board has estimated the capital costs of salt cavern storage to be

\$24.97/m<sup>3</sup> in 1979 dollars. Annual operating costs have been estimated at \$1.26/m<sup>3</sup>. The cost of crude oil to fill the caverns is based on an average cost estimate of \$179.20/m<sup>3</sup>.

Storage requirements increase in line with the increase in gas market. For example, the amount of storage required to provide 90 days protection in 1985 in Quebec would be about 387 769 m<sup>3</sup>, rising to 745 967 m<sup>3</sup> in 1990, and 1 170 462 m<sup>3</sup> in 2000.

The cost of providing storage in this way has a present value of \$89 million, in 1979 dollars. Because gas expansion is assumed to provide the same supply protection as this investment, the cost of the storage is included as a benefit of the pipeline extension. The security of supply benefit would be higher if more of the pipeline throughput could be said to provide security. For example, the estimate would be double if 180 days of throughput were deemed necessary to provide security.

TECHNICAL NOTE ON THE BOARD'S COST-BENEFIT ANALYSIS (Q & M)

Refinery Impact - The approach used by the Board to estimate the reduction in profitability of refining operations in the Maritimes is the same as that employed to analyze this impact in Quebec.

The Board estimates that the reduction in profitability over the period to the year 2000 would have a present value of \$5 million in 1979 dollars. The assumptions on product displacement, savings in refinery fuel, refinery-gate prices and savings in crude costs are contained in Table 8-14.

Comment: Other technical notes on the Board's cost-benefit analysis may be found in the TransCanada section of the report.

Table 8-14

SUMMARY OF BOARD'S ASSUMPTIONS REGARDING  
REFINERY IMPACT IN THE MARITIMES

	<u>1985</u>	<u>1990</u>	<u>1995</u>	<u>2000</u>
<u>Product Displacement</u> <sup>(1)</sup> - m <sup>3</sup> /d				
Light Fuel Oil	581	893	1 063	1 205
Heavy Fuel Oil	<u>2 583</u>	<u>1 795</u>	<u>2 333</u>	<u>2 708</u>
Total	3 164	2 688	3 396	3 913
<u>Reduction in Refinery Fuel</u> <sup>(2)</sup>				
- m <sup>3</sup> /d	174	148	187	215
<u>Refinery Gate Prices</u> <sup>(3)</sup> - \$/m <sup>3</sup>				
Light Fuel Oil	194.80	194.80	194.80	194.80
Heavy Fuel Oil	165.36	165.36	165.36	165.36
<u>Reduction in Crude Costs</u> <sup>(4)</sup>				
- \$/m <sup>3</sup>	157.50	164.35	165.04	181.90

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(1) Board's estimate.

(2) Board's estimate. Fuel savings are assumed equivalent to 5.5 percent of product displacement.

(3) Based on Exhibits 22-145 and 23-182 and Board's estimated average crude cost of \$179.20/m<sup>3</sup> in 1979 dollars.

(4) Based on Exhibits 23-21 and 23-186 and adjusted for Board's average crude costs. Refer to note following Table 8-13 in Appendix 8-B.



CHAPTER 9  
ECONOMIC VIABILITY

9.1        TransCanada

9.1.1     Views of the Applicant

TransCanada stated that its project would be economically viable if the following measures were put in place to ensure that the price of gas delivered to the user was competitive:

- (1) extension of the Eastern Zone to include the entire new market area in Quebec;
- (2) rolling in the cost of service of new facilities downstream of Montreal into TransCanada's overall cost of service;
- (3) construction of laterals and sub-laterals by TransCanada;
- (4) reduction in the price of natural gas for new domestic sales to 65 percent of Btu parity with oil at the Toronto reference point for up to ten years;
- (5) establishment of a development rate for three years from the start of service in a new area; and
- (6) establishment of a mechanism for the transfer to Alberta producers of any surplus remaining after distributors' costs have been recovered.

TransCanada argued that, provided the above measures were implemented, the revenues in the marketplace from the sale of gas would be sufficient to recover the incremental costs of distribution, transportation, gathering, production, and exploration of that gas, to be sold in the new expansion markets.

TransCanada acknowledged that although the details of the proposed tariffs would have to be determined in a rate hearing under Part IV of the National Energy Board Act, the Board could approve in principle the suggested form of the tariff and the concept of extending the Eastern Zone. During cross-examination TransCanada agreed that if a distributor had to include the cost of laterals and sub-laterals with its cost of service, there would be a distribution system deficit.

### 9.1.2 Views of Intervenors

#### BP

BP stated that there were potential disadvantages in forcing gas substitution by means of a heavily subsidized pipeline or by means of highly depressed producers' prices. Among the disadvantages mentioned were the potential for misallocation of energy investments and the possibility that any subsidies or incentives, rather than being temporary, might become permanent. BP, however, suggested that the project economics could be improved by, among other things, concentrating on the development of existing high density market areas such as Ontario and Quebec, and by limiting the life of any subsidies or incentives.

#### CPA

CPA stated that the evidence showed that the project contemplated by TransCanada would require substantial subsidies over a long period of time. However, if the Board found that gas service should be extended east of Montreal for security of supply reasons, the Association was of the view that such extension should not go beyond Quebec City.

It was the position of the Association that if a new line were approved to Quebec City, a new zone should be created to recognize the additional transportation cost, notwithstanding the possibility of some outside subvention to keep city-gate prices the same. CPA testified that the development rate for three years as proposed by TCPL would not encourage distributors to purchase gas at a high load factor or to enter into long-term purchase agreements. Furthermore, CPA opposed rolling in the cost of laterals with the transmission cost of service.

On the subject of subsidy or incentive, the Association stated:

- it should be visible and of a defined duration;
- it should reflect the incremental costs of connecting new markets;
- it should be sufficient to achieve the necessary market penetration;

- it should not lead to extended and unnecessary underpricing of natural gas; and,
- it should be shared in some realistic relationship by the potential beneficiaries of the project.

CPA further testified that the cost of extension should not fall totally and solely on gas producers in the Western Canada. Its recommendations were:

- that the Applicants should use flow-through accounting for taxes, instead of normalized taxes as proposed;
- that the federal government should provide to the project the funds which would be saved as a result of the reduction in oil compensation payments due to the displacement of oil by gas, and the funds necessary to cover the cost of any price discounting required to make gas competitive at the burner tip; and,
- that Quebec should eliminate all provincial taxes adversely affecting the proposed pipeline extension, provide the means of expediting regulatory proceedings, for determining the question of franchises for the expansion market in Quebec, and allow distributors flexibility in rate design and pricing.

The Association emphasized that in cases where revenue deficiencies would exist, it was important to assess the full extent of that deficiency by reviewing the incremental costs involved. It further stated that incremental costs as opposed to rolled-in costs were the costs that should be used by the Board in its determination of whether a particular application could be found to be in the public interest.

#### Consumers'

It was Consumers' position that even if the project failed the test of accepted utility economics, it would support the project if the Board found it to be in the national interest. Consumers' recommended that any subsidies to be paid should come out of the general tax revenues of Canada so that no individual sector of the natural gas industry would bear an undue share of the cost, and the accepted

principles and practices of utility regulation would remain intact. It further recommended that a new rate zone should be created for the new market area.

### Gaz Métropolitain

Gaz Métropolitain stated that certain incentive measures would be necessary to eliminate the deficiency with respect to revenues required to ensure an adequate return on investment related to the distribution of gas in new Quebec markets. The measures it suggested were that the eight percent provincial sales tax would have to be neutralized and a credit of 38 cents per GJ on the Alberta gas price would have to be available to the distributor. Gaz Métropolitain also suggested certain additional measures which would be desirable, such as a development rate applicable to expansion volumes over a period of 36 months the Toronto reference price indexed at 80 percent Btu parity, and abolition of the dues being paid by the distributors to the Régie d'électricité et du gaz. These latter three measures together would reduce any deficiency by \$301 million or 44 cents per GJ. During cross-examination Gaz Métropolitain agreed that its gas pricing proposals were approximately equivalent to the 65 percent city-gate price suggested by the Applicant.

### IPAC

IPAC stated that the costs of TransCanada's project would exceed the revenues from the sales of gas. In its view there was some doubt that a 65 percent incentive price would ever be in place. Further, there was as yet no agreement as to how any surpluses would flow back from the distributor to the producer.

Thus, the extension of natural gas service to markets east of Montreal could not be justified on simple economic grounds. However, it was the position of IPAC that the Board should not issue a certificate to extend the pipeline beyond Trois-Rivières at this time. It suggested that Trois-Rivières was a logical place to stop when incremental costs of finding gas in Alberta and "geographical" factors were taken into account. IPAC was prepared to accept the netback at the Alberta border associated with extending the pipeline as far as Trois-Rivières.



In IPAC's view, rate-making and cost analysis should be differentiated. In deciding whether or not to proceed with the construction of facilities, it was necessary to use an incremental analysis.

IPAC stated that if subsidies were judged necessary, the amount of subsidy required and the sources of the subsidy should be identified.

#### IGUA

IGUA provided an analysis of the incremental economics of several segments of TransCanada's proposed facilities in Quebec.

IGUA stated that the cost effectiveness of the various laterals could be determined by calculating the cost in terms of crude oil displaced. The Association stated that the cost of extending the transmission service to some of the more remote and smaller markets within Quebec would be considerable. IGUA estimated the total amount of subsidy required for service within Quebec to be \$1,212 million in current dollars for the period ending 1990. IGUA testified that the producers would take action if the Alberta border price got too low as a result of extending the Eastern Zone and the rolling-in of the cost of new facilities into TransCanada's overall cost of service. IGUA was of the opinion that existing Eastern Zone gas customers would then have to pay the extra delivery costs associated with the extension and it was IGUA's position that present users of natural gas should incur no extra costs.

IGUA testified that any extension of service in Quebec should be conditional upon adequate government subsidies being provided.

#### Norcen

Norcen stated that the Board should assess the viability of the project in terms of the total costs on an incremental basis, rather than on a rolled-in basis. On an incremental basis, Norcen estimated the revenue deficiencies at \$1,966 million over the ten-year period to 1990 for the Quebec expansion market. Norcen pointed out that although the Quebec expansion would result in a negative netback to producers in the initial period, by 1984 the economics should become favourable. Norcen stated that the key to expansion of gas service in Quebec was the

establishment of mechanisms to cover this deficiency. These mechanisms included those necessary to pay for conversion costs, the extension of the Eastern Zone, the establishment of a development rate, the granting of tax concessions to distributors by municipalities and by the Province, and reduction of front-end costs. Norcen concluded that the application of TransCanada to extend gas facilities in Quebec should be approved.

#### Manitoba

Manitoba submitted that the project was uneconomic since the costs would exceed revenues and the project would therefore need financial support. The Province stated that if the project were found to be in the national interest and if additional financial assistance were required, such financial support should come from the Federal Government. Manitoba stated that it would receive no direct benefit from the pipeline extension and ought not to be placed in a position to pay higher rates. The Province was against the proposed TCPL rate design which charged a higher unit cost to customers upstream of the Eastern Zone.

#### Ontario

Ontario supported the extension of service to Quebec City on condition:

- that the incentive pricing plan was put in place;
- that the distribution laterals were included in the transmission rate base assuming that it was supported by Alberta and that the same concept would apply across Canada to make natural gas available to areas of Ontario not presently served; and
- that these incentives were sufficient to make the project economic.

Ontario stated that extension of the system to Quebec City could perhaps be justified on the grounds that this part of the project provided the most benefit in the form of oil displacement at the least capital cost. While the project was not economically feasible in the traditional sense, reasonable subsidies and discounts from Alberta could make the project viable.

Ontario also stated that a separate zone for the Province of Quebec should be established and that all costs of that zone, including upstream facilities required to support the extension, should be identified and included in this new zone.

#### Quebec

Quebec supported the expansion and the extension of natural gas markets in the province and stated that it was willing to take action to assist gas penetration in Quebec. Quebec stated that it had already neutralized the effect of municipal taxation on competing energy forms, that a distributor or distributors would be selected quickly, and that it would neutralize the sales tax on natural gas. Under cross-examination, Quebec indicated that other measures were also under consideration. These included possible elimination of the provincial sales tax applicable to natural gas equipment and possible modification of the dues being paid by the distributors to the Régie d'électricité et du gaz.

Quebec stated that in order to achieve any penetration in Quebec, gas would have to be competitive with other existing energy sources and conversion costs would have to be subsidized. Quebec indicated that discussion with Alberta had led to the recommendation that funds generated from reducing the price of gas from 85 percent to 65 percent Btu parity, could serve to subsidize the conversion costs of new customers in Quebec. It also stated that this agreement had not yet been ratified.

In its view new customers in the Province should not pay a higher transportation cost for Alberta gas than that paid in the present Eastern Zone. Quebec agreed that if the Eastern Zone were extended, gas producers would bear most of the additional costs; however, it stated that the Federal Government should also provided assistance because of the overall benefits accruing to Canada.

#### Saskatchewan

Saskatchewan stated that the viability of the pipeline had not been demonstrated and that the pipeline could cause a substantial and unreasonable increase in tariffs paid by existing gas consumers in

Saskatchewan and elsewhere. It further stated that the desirability of the pipeline depended upon the long-term adequacy of the Canadian gas supply to sustain the new markets and the price at which natural gas would be available in the new market.

#### 9.1.3 Views of the Board

TransCanada relied on evidence it had provided jointly with Q & M on the economic viability of the whole project from Montreal to Halifax. In order to focus on the financial economics of the project in Quebec, the Board has prepared its own analysis, based on evidence given at the hearing. The Board notes that in preparing its analysis it has used oil price assumptions reflecting the January 1980 level of world oil prices of \$206.43 per cubic metre landed in Montreal. For purposes of this analysis, the Board has assumed that world oil prices will remain constant in real dollar terms, and that domestic oil prices will be phased up to world levels by the end of 1985. TransCanada used data reflecting world oil prices conditions as of the Fall of 1979 when these prices were significantly lower. The Board's results are shown below in Table 9-1.

Furthermore, to clarify the nature of the pricing and financial requirements of the project in Quebec, the Board has estimated the financial deficiencies of the proposed distribution system as if gas expansion in Quebec would be considered as an expansion of TransCanada into a new tariff zone, assuming that the price of gas in the Eastern zone remained at 85 percent parity.

More specifically, Rows 1 to 5 of Table 9-1 are based on the following assumptions;

- (i) incremental cost of service upstream of Montreal would be rolled in;
- (ii) incremental cost of service downstream from Montreal would not be rolled in;
- (iii) the Eastern Zone price for expansion market gas would remain at 85 percent Btu parity;
- (iv) the cost of new laterals would be included in the cost of service downstream of Montreal; and



Table 9-1  
SUMMARY OF BOARD'S ESTIMATE OF  
ECONOMIC VIABILITY OF THE TRANSCANADA PROJECT  
TO LEVÍS-LAUZON

	Units	1981	1982	1983	1984 (current dollars in volumes)	1985	1986 in volumes)	1987	1988	1989	1990	Total
<b>85% Parity Scenario:</b>												
TCPL incremental cost of service upstream of Montreal rolled in. TCPL incremental cost of service downstream of Montreal added on. Eastern Zone reference price at 85% parity with oil adjusted for 90% load factor. Cost of laterals included in TCPL cost of service.												
1. Cost of Gas:												
(a) Eastern Zone Price at 85% Btu parity & 90% Load factor	\$/GJ	3.12	3.84	4.53	5.23	5.93	6.68	7.05	7.47	7.90	8.37	
(b) TCPL Transmission Cost of Service related to facilities from Montreal to Levis-Lauzon	\$/GJ	3.15	2.71	2.15	1.67	1.45	1.27	1.11	1.02	0.90	0.80	
(c) Average of Distribution Cost of Service plus any Conversion Costs paid by Distributors in Quebec	\$/GJ	0.77	0.90	0.81	1.03	1.23	1.26	1.33	1.42	1.55	1.69	
(d) Total costs to Burner Tip (a+b+c)	\$/GJ	7.04	7.45	7.49	7.93	8.61	9.21	9.49	9.91	10.35	10.86	
2. Retail Revenues:												
Weighted average of burner tip prices necessary to achieve penetration. Assumes parity with fuel oil or 25% discount below electricity	\$/GJ	3.25	3.93	5.05	5.47	5.99	6.96	7.59	8.16	8.62	9.10	
3. Distribution System Revenue Deficiency: (2-1)	\$/GJ	(3.79)	(3.52)	(2.44)	(2.46)	(2.62)	(2.25)	(1.90)	(1.75)	(1.73)	(1.76)	
4. Annual Sales Volumes in Quebec expansion market.	PJ	7.8	19.5	31.3	59.3	73.3	85.7	98.7	112.2	127.4	144.9	
5. Annual Distribution System Deficiency: (3x4)	\$x10 <sup>6</sup>	(29.6)	(68.6)	(76.4)	(145.9)	(192.1)	(192.8)	(187.5)	(196.4)	(220.4)	(255.0)	(1564.7)
Proposed Incentive Pricing Provisions:												
TCPL downstream cost of service rolled in, 65% parity												
6. Reduction due to rolling in downstream costs	\$/GJ	3.15	2.71	2.15	1.67	1.45	1.27	1.11	1.02	0.90	0.80	
7. Reduction due to 65% parity	\$/GJ	0.72	0.88	1.05	1.21	1.37	1.56	1.64	1.74	1.84	1.94	
8. Distribution System Revenue Surplus (3+6+7)	\$/GJ	0.08	0.07	0.76	0.42	0.20	0.58	0.85	1.01	1.01	0.98	
9. Distribution System Annual Surplus (8x4)	\$x10 <sup>6</sup>	0.6	1.4	23.8	24.9	14.7	49.7	83.9	113.3	128.7	142.0	583.0

- (v) gas would be priced at the burner tip at levels proposed by TCPL in order to effect penetration of markets.

Under the above 85 percent parity scenario the distributor would have to buy gas at its city-gate at a price equal to the 85 percent parity value at Montreal plus the TCPL cost of service from Montreal to its city-gate. To realize sales, however, the distributor would have to price gas at the burner tip in competition with other fuels (Row 2). Row 5 of Table 9-1 shows the Board's estimate of the substantial and consistent financial distributor deficits which would result under these conditions; i.e., deficits of some \$29.6 million in 1981, rising to about \$200 million per year by the late 1980's.

Under TransCanada's proposed incentive pricing provisions which include extending the Eastern Zone, whereby downstream mainline and lateral costs of service would be rolled in, and whereby expansion gas volumes would be priced at 65 percent parity throughout the extended Eastern Zone, the Board estimates that the distributors could be in a surplus position, even in the initial years and increasingly so over the life of the project (Row 9). TransCanada argued that, with appropriate provisions, any distributor surplus could be flowed back to the producing sector. It was on these grounds that TCPL asserted that no direct subsidy was required to make the project in Quebec economically viable. The Board does not accept the proposition that no subsidy would be involved, but it does find that under the proposed provisions of incentive gas pricing (which would require Federal and Provincial government ratification) the project in Quebec would be economically viable.

As well, the Board notes that some intervenors said that under the incentive pricing scheme proposed by TransCanada, the producing sector and possibly existing gas customers would be required to support or "subsidize" the project indirectly by paying for higher transmission costs. However, the Board also notes that despite these concerns, most of the intervenors expressed a measure of support for TransCanada's application, if the project were found to be in the national interest.

The Board also notes that, among the intervenors, IPAC stated that the netback associated with extending service to the new Montreal area markets and the Trois-Rivières markets would be acceptable, and Norcen stated that the economics associated with TransCanada's expansion in Quebec could become favourable upon realization of the market potential.

Turning to the Provinces, the Board notes that while Quebec supported the TransCanada application, Saskatchewan stated that the viability of TransCanada's project had not been demonstrated. The Board further notes that Manitoba stated that if the project were found to be in the public interest any financial support should come from the federal government. The position of Ontario was to support market expansion on the condition that the price incentives proposed were acceptable to Alberta, and were sufficient to make the project economically viable.

Accepting that the project in Quebec can be made economically viable, it is proper for the Board to clarify, to the extent possible, the nature and scope of the contingent subsidies.

To illuminate the question of the nature of the subsidies the Board has found it is useful to define various types of financial transfers, or forms of financial assistance. In the context of this project there are three distinct, but often closely related, types of "subsidy", as follows;

Direct Government Assistance, i.e. direct financial assistance to the project or to consumers of the gas from general revenues of the Federal (or Provincial) government.  
e.g., direct government payments to reduce tariffs.

Indirect Government Assistance, i.e. Indirect financial assistance to the project or to consumers as a result of fiscal or related policy of the Federal (or Provincial) government.  
e.g., Change in tax provisions for project.

Government Induced Redistribution, i.e. Government induced transfer of funds usually from one non-government sector to another, and sometimes involving other governments. e.g., Expansion market gas pricing at 65 percent Btu parity, rather than 85 percent parity.

These three categories relate to financial subsidies and transfers, and each may have a bearing upon how (and whether) the project can be made workable; that is, how it can be made economically viable.

The scope, or size, of the various financial transfers involved can be discerned through financial analysis as presented in Table 9-1. It is the Board's view that the proper measure of the net economic cost to Canada, if any, is through Cost-Benefit Analysis, as described in a previous section of this report. Cost-Benefit methodology, of course, treats all cash flows on an incremental basis.

As previously mentioned, Row 5 of Table 9-1 shows an estimate of the annual financial deficiency that distributors would face if no provisions are put in place to promote gas expansion. For the project to be viable these deficiencies must be covered, either directly or indirectly. TransCanada's proposed incentive pricing provisions would shift these financial costs to the producing sector where they would be shared approximately 47 percent by industry, 36 percent by Alberta, and 17 percent by the Federal Government, as estimated by the Board.

In considering the meaning of these financial transfers (Government Induced Redistribution) the Board emphasizes that they do not measure the economic impact of the project upon the producing sector. The Board's Cost-Benefit analysis assesses net economic costs and benefits considering these matters, in Section 8.1.5.

The effect of the project on the revenues to the producing sector can be estimated by considering gas sales quantities and revenues to that sector with the TCPL project as against either (i) not selling those project quantities, or (ii) selling those project quantities in the export market. Existing exports and normal domestic sales, as well as project quantities, will change over the near-term period and therefore



the Board has made a comparison based on 1985 expected quantities. In the first case, given the TCPL project compared with not selling that gas, the Board estimates that the average natural gas revenue per GJ to the producing sector in 1985 would be about 1 percent lower but total revenues would be higher. In the second case, given the TCPL project compared to exporting the gas, the Board estimates that the average natural gas revenue per GJ in 1985 would be about 2 percent lower, and total revenues would also be lower.

The Board concludes that TransCanada's proposed pricing provisions could sustain the economic viability of the project in Quebec. The measures suggested by TCPL require Federal and Provincial government agreement, notably Alberta and Quebec, as well as acceptance by industry. They do not involve Direct or Indirect Government Assistance (as defined above) but they do imply a Government Induced Redistribution of funds.

To summarize, the Board finds that TransCanada's project in Quebec is economically viable provided that the proposed pricing incentives, or some equivalent provisions, are in place.

## 9.2 Q & M

### 9.2.1 Views of the Applicant

In discussing economic viability, Q & M assessed the economics of the combined pipeline projects from Montreal to Halifax and did not provide separate evidence pertaining to its own application for pipeline facilities from Lévis-Lauzon to Halifax. Q & M stated that the combined pipeline would be economically viable if the following measures were adopted:

- (1) rolling in of the cost of service for new facilities upstream of Montreal into TCPL's overall cost of service;
- (2) extension of the Eastern Zone as far as Halifax to include the entire new market area in Quebec, New Brunswick and Nova Scotia;
- (3) rolling-in of the cost of service for new facilities downstream of Montreal into TCPL's overall cost of service;

Table 9-2

VIEWS OF APPLICANTS  
Q & M (SUMMARIZED) ECONOMIC VIABILITY - OF THE TRANSCANADA  
AND Q & M PROJECTS FROM MONTREAL TO HALIFAX

	Units	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total
							(current dollars or volumes)					
<u>85% Parity Pricing Scenario:</u>												
TCPL incremental cost of service upstream of Montreal rolled in. TCPL/Q&M incremental cost of service downstream of Montreal added on. Toronto reference price at 85% energy equivalence adjusted for 90% load factor. Cost of laterals included in TCPL/Q&M cost of service												
1. Cost of Gas:												
(a) Toronto City Gate Price: Fig. 4.D.3-2JA	\$/GJ	2.81	3.33	3.92	4.63	5.44	5.82	6.13	6.51	7.00	7.79	
(b) TCPL incremental cost of service downstream of Montreal: Fig. 3.H.4-8 JA	\$/GJ	2.34	2.64	2.37	1.96	1.72	1.37	1.22	1.06	0.94	0.85	
(c) Average distribution cost of service plus any conversion and promotion costs paid by distributors in all three provinces: Fig. 3.H.4-8JA	\$/GJ	0.64	0.74	1.00	1.06	1.20	1.34	1.42	1.43	1.46	1.54	
(d) Total Costs to Burner Tip (a+b+c)	\$/GJ	5.79	6.71	7.29	7.65	8.36	8.53	8.77	9.00	9.40	10.18	
2. Retail Revenues:												
Weighted average Burner Tip prices necessary to achieve penetration: Fig. 3.H.4-9JA	\$/GJ	3.02	3.54	4.10	4.82	5.68	6.24	6.77	7.40	8.02	8.90	
3. Distribution System Revenue Deficiency: (2-1)	\$/GJ	(2.77)	(3.17)	(3.19)	(2.83)	(2.68)	(2.29)	(2.00)	(1.60)	(1.38)	(1.28)	
4. Annual Sales Volumes: Fig. 4.D.3-1JA	PJ	11.07	26.68	60.11	93.44	114.11	140.58	159.88	185.08	210.29	230.33	
5. Distribution System Annual Deficiency: (3x4)	\$MM	(30.7)	(84.6)	(191.8)	(264.4)	(305.8)	(321.9)	(319.8)	(296.1)	(290.2)	(294.8)	(2400.1)
Proposed Incentive Pricing Provisions:												
TCPL downstream cost of service rolled in, 65% energy equivalence. Flowback of distributors' surplus.												
6. Reduction due to rolling in downstream costs: Fig. 3.H.4-10JA	\$/GJ	2.34	2.64	2.37	1.96	1.72	1.37	1.22	1.06	0.94	0.85	
7. Reduction due to 65% energy equivalence: Fig. 3.H.4-10JA	\$/GJ	0.64	0.77	0.90	1.07	1.26	1.36	1.42	1.51	1.62	1.81	
8. Distribution System Revenue Surplus (3+6+7)	\$/GJ	0.21	0.24	0.08	0.20	0.30	0.44	0.64	0.97	1.18	1.38	
9. Distribution System Annual Surplus: (8x4)	\$x10 <sup>6</sup>	2.3	6.4	4.8	18.7	34.2	61.9	102.3	179.5	248.1	317.9	976.1
10. Incremental Revenue at the Fieldgate due to gas sales in TCPL/Q&M market area W/O flowback of distribution system surplus: Exhibit 23-209	\$x10 <sup>6</sup>	(8.6)	(16.5)	(24.8)	47.8	115.4	238.2	356.3	484.3	663.5	935.6	2791.2
11. Incremental Revenue at the Fieldgate due to gas sales in TCPL/Q&M market area with flowback of distribution system surplus: (9+10)	\$x10 <sup>6</sup>	(6.3)	(10.1)	(20.0)	66.5	149.6	300.1	458.6	663.8	911.6	1253.5	3767.3

- (4) reduction in the price of natural gas for new domestic sales to 65 percent of Btu parity with oil at the Toronto reference point;
- (5) construction of laterals by TCPL and Q & M; and,
- (6) establishment of a mechanism for the transfer to Alberta producers of any surplus remaining after recovery of distributors' costs.

Based on these assumptions, Q & M calculated the economic viability of the combined Q & M and TransCanada projects, and this is summarized in Table 9-2.

These estimates showed the costs and revenues of providing gas service to the burner tip under pricing at 85 percent Btu parity with oil with upstream costs rolled in. Also, calculations were provided to show the costs and revenues that would occur if the proposed pricing provisions were put in place. The calculations supplied by Q & M indicated (at Rows 1 to 5) that under the 85 percent pricing scenario, substantial deficits would be incurred by the distributor. Under the Applicant's proposed incentive pricing assumptions, the calculations indicate (as shown in rows 6 to 9) that the combined projects would, on average, yield a surplus of revenue over the costs incurred by distributors.

Q & M acknowledged that, in the absence of action by governments, its calculations, based on current pricing and tax policies, indicated that the pipeline system would not be viable. The Applicant also stated that under present pricing policies, the two sources of funds to eliminate any deficits were the various levels of government (municipal, provincial and federal) and the gas producers, but added that those who benefit from the pipeline project should also make contributions. Q & M also recognized that the producers would have to accept lower netbacks and therefore lower profits, as compared to exporting the gas.

Also Q & M agreed that all sources of funds to meet revenue deficiencies would have to be identified and agreements reached before the Board could authorize construction of the facilities.

During cross-examination Q & M was asked whether it would accept a lower rate of return in early years to reduce front-end costs. Q & M's position was that, if it were to share in any front-end risk it should also be considered when it came to sharing the long term surpluses.

In addition to the measures it had proposed, Q & M testified that other actions could be taken to assist the project. It said that New Brunswick and Nova Scotia should consider reviewing their sales tax provisions for major equipment used temporarily in the province and should also consider the possibility of allowing distributors respite from municipal taxes. Furthermore, the provinces should promptly select distributors who would aggressively market gas. Also they should allow flexibility in rate making to enable distributors to respond to any competition from oil. Also, the Federal Government could take fiscal measures, such as allowing the rapid write-off of conversion costs.

#### 9.2.2 Views of Intervenors

##### BP

BP's position on the extension of the natural gas pipeline was that the disadvantages that could result from forcing gas substitution by means of a heavily subsidized pipeline or highly depressed producers' prices should be taken into account. BP stated that these disadvantages could be minimized by concentrating on the development of existing high density market areas; limiting the life of any subsidies or incentives to utilities; and deferring pipeline extensions to regions where offshore or frontier oil or gas is likely to provide a more economic alternative.

##### CPA

The Association stated that in its view a revenue deficiency would exist in extending gas pipeline service to the Maritimes and that this deficiency would exceed that associated with the TransCanada project. When this economic consideration was combined with the prospect of hydrocarbon developments on the East Coast, CPA concluded that it would be premature to grant a certificate for a pipeline further than Quebec City at this time, and that a decision on Q & M's pipeline facilities should be deferred.



Consumers'

Although Consumers' did not wish to obstruct the extension of gas service into the Maritime provinces, it stated that extension of service must be justified on economic grounds. Consumers' stated that the distributor's revenue deficiencies could be very large in the Maritime markets, particularly if the volumes of gas forecasted to be sold for thermal generating purposes did not qualify for the incentive pricing scheme. Consumers' stated that the revenue deficiency in Nova Scotia would be "simply staggering" if it were necessary to provide that Province with the same price advantage relative to alternative fuels as were thought to exist in Ontario.

It was Consumers' position that the Q & M project failed the test of accepted utility economics. However, if the Board found the combined projects of TCPL and Q & M to be in the public interest, then the subsidies should be paid from the general revenues of Canada, and among other things a new rate zone or zones could and should be created for the new market areas.

IPAC

IPAC stated that the amount of gas reserves in the Sable Island area and the viability of a pipeline from Sable Island to shore had to be determined before a decision could be made in respect of Q&M's proposal to extend a natural gas service to the Maritimes. Based on economic viability calculations using an incremental approach, the Association concluded that the extension of a pipeline to the Maritimes would not be economic. IPAC submitted that the Q & M application should be denied.

IGUA

IGUA provided an analysis of the cost effectiveness of the proposed extension of gas transmission and distribution service to the Maritimes in terms of "subsidy" per unit of crude oil displaced. On an incremental basis IGUA calculated the cost of service to the Maritimes at \$152.80 per cubic metre of oil displaced as compared to \$56.60 per cubic metre for service in Quebec. In its calculation the Association estimated the subsidy required for the combined Q & M/TransCanada projects at \$2.3 billion in current dollars over the ten-year period ending 1990.

It was IGUA's position that the evidence provided by Q & M failed to show that the extension of gas service to the Maritimes would be economically viable.

#### Norcen

Norcen stated that the Q & M application would provide a very small contribution to energy self-sufficiency at a very high incremental cost. Norcen calculated that deficits attributable to the Maritimes portion would total \$1,290 million and yield a negative revenue at the fieldgate until 1989.

Norcen calculated the average deficit in the Maritimes to be \$4.50 per GJ. This compared to a deficit of \$2.08 per GJ that would result from approving TCPL's application concerning facilities in Quebec.

The Company stated that the application of Q & M ought not to be dismissed but adjourned sine die, and recommended that the application be revised when information was available on the feasibility of developing Hibernia and Sable Island reserves, the costs of other energy alternatives could be assessed, and demand could be more precisely identified.

#### New Brunswick

New Brunswick stated that gas could not be competitive with oil in new market areas without "price adjustment", and therefore replacing oil with gas would require significant subsidization. The Province submitted that all energy options should be examined to determine the best available option and recommended that the Board delay its decision on the Q & M application until sufficient information on potential sources of hydrocarbons became available.

The Province provided calculations to show that on an incremental basis, the cost of using Alberta gas at the burner tip in New Brunswick would exceed the cost of using oil by \$989 million over the period 1981-1995. When the cost of facilities west of Montreal were rolled in with existing facilities, the Province found that the cost of using gas in New Brunswick still exceeded the cost of using oil by \$526 million. However, if the Eastern Zone were extended and the Toronto

reference price were applicable throughout the new Eastern Zone, the Province concluded that there would be no significant net cost disadvantage to New Brunswick for gas.

On the subject of possible incentives to encourage the sale of gas in New Brunswick, the witness for New Brunswick stated that the Province would consider all methods of making gas available to potential users, but would not commit itself to the abatement of sales or municipal taxes.

#### Newfoundland

Newfoundland did not oppose the introduction of gas to the Eastern Provinces, but wanted a thorough examination of the costs involved, including the costs of alternative energy sources. The Province stated that support of the gas pipeline extension through lower gas pricing and the resulting lower tax revenues, should not be considered a subsidy.

Newfoundland said that if a Federal subsidy were given to make gas available in New Brunswick and Nova Scotia, the Federal Government should provide an equivalent benefit to provinces where gas service was not available.

#### Nova Scotia

In Nova Scotia's view, rolling in transmission costs upstream and downstream of Montreal, and reducing the Toronto reference price to a range of 60 to 70 percent of Btu parity would ensure that natural gas would be competitive in the Maritimes. Nova Scotia testified that the pipeline could be financed by revenue from the sale of natural gas although these measures would lower the netback to Alberta producers. In its view, a federal subsidy was not required.

Nova Scotia defined subsidy as something that is provided primarily by governments to offset certain disadvantages that a region or a group may be experiencing. When being cross-examined on potential Provincial contributions, the Nova Scotia witness testified that a subsidy from the Province would amount to an increased burden upon the very people the project was designed to help.



Nova Scotia, however, agreed to consider waiving the sales tax on conversion equipment to assist market penetration and, in addition, to review the sales tax treatment for equipment brought into the Province on a temporary basis during the construction period. As well, the Province agreed to examine with the municipalities, the possibility of waiving or reducing municipal taxes on distribution systems during the initial years of the project.

The Province stated that it could not accept a burner tip price higher than that prevailing in Ontario and Quebec.

Nova Scotia suggested that the economic viability of the project should be assessed in a national context and considered the cost-benefit analysis to be an appropriate method in this regard.

It was Nova Scotia's view that the project had met the test of economic viability.

#### Ontario

Ontario stated that funds would have to found to heavily subsidize conversion and distribution costs in the Maritimes, if the Q & M project were approved. In its view, because the source, size and nature of the necessary subsidies had not been firmly established, the economic viability of the extension of natural gas service to the Maritimes had not been demonstrated. For these reasons, among others, the Province recommended that a decision on the Q & M Application be deferred.

#### 9.2.3 Views of the Board

Q & M provided evidence that the combined Q & M and TransCanada projects could be economically viable as a result of the proposed pricing and tariff provisions in the sense that overall distributor revenues would be sufficient to cover the distributors' own costs and the costs of gas at the distributors' city-gate. The Board agrees with this contention, and as is shown in Table 9-3, row 9, the Board estimates that the combined projects would appear, on average, to be economically viable, although 1982 shows a deficit. The Board notes that in preparing its analysis, while relying upon the evidence, it has used oil price assumptions reflecting world oil prices as in January 1980, while the Applicants used data reflecting world oil price conditions as of the fall of 1979 when these prices were significantly lower.



Table 9-3  
SUMMARY OF BOARD'S ESTIMATE OF  
ECONOMIC VIABILITY OF THE TRANSCANADA & Q & M  
PROJECTS FROM MONTREAL TO HALIFAX

	Units	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total
<u>85% Parity Scenario:</u>												
TCPL incremental cost of service upstream of Montreal rolled in, TCPL/Q&M incremental cost of service downstream of Montreal added on. Eastern Zone reference price at 85% parity with oil adjusted for 90% load factor. Cost of laterals included in TCPL/Q&M cost of service												
1. Cost of Gas:												
(a) Eastern Zone Price at 85% parity & 90% load factor	\$/GJ	3.12	3.84	4.53	5.23	5.93	6.68	7.05	7.47	7.90	8.37	
(b) Q&M/TCPL incremental cost of service downstream of Montreal	\$/GJ	3.79	3.29	2.20	1.94	1.75	1.68	1.56	1.48	1.34	1.20	
(c) Average Distribution, Conversion & Promotion Costs in Quebec, Nova Scotia & New Brunswick.	\$/GJ	0.77	1.27	0.85	0.96	1.10	1.24	1.33	1.44	1.54	1.65	
(d) Total costs to Burner Tip (a+b+c)	\$/GJ	7.68	8.40	7.58	8.13	8.78	9.60	9.94	10.39	10.78	11.22	
2. Retail Revenues:												
Weighted average of burner tip prices necessary to achieve penetration. Assumes parity with fuel oil or 25% discount below electricity in Quebec and discount from fuel oil prices in Maritimes	\$/GJ	3.25	3.81	4.56	5.22	5.83	6.79	7.40	8.03	8.57	9.14	
3. Distribution System Revenue Deficiency: (2-1)	\$/GJ	(4.43)	(4.59)	(3.02)	(2.91)	(2.95)	(2.81)	(2.54)	(2.36)	(2.21)	(2.08)	
4. Annual Sales Volumes in Quebec & Maritimes Exp. Markets	PJ	7.8	25.6	65.7	102.6	122.6	128.3	138.2	151.3	167.7	187.6	
5. Annual Distribution System Deficiency: (3x4)	\$x10 <sup>6</sup>	(34.6)	(117.5)	(198.4)	(298.6)	(361.7)	(360.5)	(351.0)	(357.1)	(370.6)	(390.2)	(2840.2)
<u>Proposed Incentive Pricing Provisions:</u>												
6. Reduction due to rolling in downstream costs	\$/GJ	3.79	3.29	2.20	1.94	1.75	1.68	1.56	1.48	1.34	1.20	
7. Reduction due to 65% parity	\$/GJ	0.72	0.88	1.05	1.21	1.37	1.56	1.64	1.74	1.84	1.94	
8. Distribution System Revenue Surplus (3+6+7)	\$/GJ	0.08	(0.42)	0.23	0.24	0.17	0.43	0.66	0.86	0.97	1.06	
9. Distribution System Annual Surplus (8x4)	\$x10 <sup>6</sup>	0.6	(10.8)	15.1	24.6	20.8	55.2	91.2	130.1	162.7	198.9	688.3

However, to bring the proposed project east of Lévis-Lauzon into focus, the Board has examined the Q & M project separately, using the proposed gas pricing provisions of both Applicants (65 percent Btu parity pricing for expansion market gas, extended Eastern Zone, etc.).

Table 9-4 shows Board estimates, based on evidence presented during the hearing, of financial flows related to the Q & M market area. Row 9 contains estimates of distributor deficits and surpluses. In contrast to the Board's estimates for the Quebec portion of the project, as outlined previously, the viability of the Q & M project cannot be reasonably assured under the proposed conditions because, in the initial years, the distributors would be in a deficit position. The estimated Q & M distributor deficit would be small, around some \$13 million, but would not be fully recovered until 1987, and evidently some further incentive pricing measures would have to be put in place to assure economic viability of the distributors and thus of the proposed Q & M project itself.

The Board's finding that further incentive pricing measures would be required coincides with the views of most of the intervenors, who, while not unanimous, agreed that in the absence of additional government actions over and above those proposed by the Applicants, a significant revenue deficiency would occur at the distributor level.

The Board notes that most intervenors suggested that the Q & M application be deferred to take into account offshore or frontier oil and gas prospects and in view of the high level of financial assistance required. The Board agrees with Norcen and IGUA that the deficits on a unit basis would be higher in the Maritimes than in Quebec in the absence of the proposed incentive measures. The Board notes that Nova Scotia stated that the pipeline was feasible and financeable, under Q & M's pricing measures, by the revenues from the sale of natural gas, without the need of a federal subsidy. The Board also notes that the other consuming province, New Brunswick, stated that the Q & M project would require significant subsidization in order to replace oil with gas. The Board agrees with the position of New Brunswick and most intervenors that Q & M did not clearly show that extension of gas service was economically viable, at this time.

Table 9-4  
SUMMARY OF BOARD'S ESTIMATE OF  
ECONOMIC VIABILITY OF THE Q & M PROJECT  
FROM LEVIS-LAUZON TO HALIFAX

	Units	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	TOTAL
(current dollars or volumes)												
85% Parity Scenario:												
TCPL incremental cost of service upstream of Montreal rolled in. TCPL/Q&M incremental cost of services downstream of Montreal added on. Eastern Zone reference price at 85% parity with oil adjusted for 90% load factor. Cost of laterals included in TCPL/Q&M cost of service.												
1. Cost of Gas:												
(a) Eastern Zone Price at 85% parity & 90% load factor	\$/GJ	3.84	4.53	5.23	5.93	6.68	7.05	7.47	7.90	8.37		
(b) Q&M/TransCanada Transmission Cost of Service	\$/GJ	5.25	2.24	2.32	2.19	2.49	2.70	2.81	2.75	2.59		
(c) Average Distribution Costs in New Brunswick and Nova Scotia	\$/GJ	2.44	0.70	0.87	0.89	1.20	1.35	1.47	1.51	1.53		
(d) Total costs to Burner Tip (a+b+c)	\$/GJ	11.53	7.47	8.42	9.01	10.37	11.10	11.75	12.16	12.49		
2. Retail Revenues:												
Average Market Clearing Price based on discount from fuel oil prices in New Brunswick and Nova Scotia	\$/GJ	3.43	4.15	4.89	5.60	6.45	6.94	7.67	8.43	9.26		
3. Distribution System Revenue Deficiency: (2-1)	\$/GJ	(8.10)	(3.32)	(3.53)	(3.41)	(3.92)	(4.16)	(4.08)	(3.73)	(3.23)		
4. Annual Sales Volumes in Maritimes expansion market	PJ	6.1	34.4	43.3	49.3	42.6	39.5	39.1	40.3	42.7		
5. Annual Distribution System Deficiency: (3x4)	\$x10 <sup>6</sup>	(49.4)	(114.2)	(152.8)	(168.1)	(167.0)	(164.3)	(159.5)	(150.3)	(137.9)		(1263.5)
Proposed Incentive Pricing Provisions:												
TCPL downstream cost of service rolled in 65% parity												
6. Reduction due to rolling in downstream costs	\$/GJ	5.25	2.24	2.32	2.19	2.49	2.70	2.81	2.75	2.59		
7. Reduction due to 65% parity	\$/GJ	0.88	1.05	1.21	1.37	1.56	1.64	1.74	1.84	1.94		
8. Distribution System Revenue Surplus (3+6+7)	\$/GJ	(1.97)	(0.03)	—	0.15	0.13	0.18	0.47	0.86	1.30		
9. Distribution System Annual Surplus (8x4)	\$x10 <sup>6</sup>	(12.0)	(1.0)	—	7.4	5.5	7.1	18.4	34.7	55.5		115.6

The Board notes that the Government Induced Redistribution of funds implied by the proposed Q & M pipeline project, as indicated by the deficiency quantities shown in Row 5 of Table 9-4 amount to some \$120 to \$170 million annually in the period to 1990, although they pertain to gas volumes which are only about a third of those that are forecast for the TransCanada project in Quebec.

Based on the evidence and on the Board's analysis, the Board agrees with Q & M that if governments were to take the measures as proposed by the Applicants to promote the expansion of gas sales, it would appear that the combined Q & M and TransCanada pipeline projects could be economically viable because average distributor revenues would cover distributor costs. However, the Board finds that the Applicant has not demonstrated that distributors in New Brunswick and Nova Scotia would be placed in an economically viable position in the initial years. Therefore, the Board believes that further incentive pricing provisions, beyond those proposed, would be required for economic viability to be clearly demonstrated for the Q & M project.



CHAPTER 10SECURITY OF SUPPLY AND SELF-RELIANCE10.1 TransCanada10.1.1 Evidence of the Applicant

TransCanada submitted that extending natural gas transmission further into Quebec and the Atlantic Region would contribute to the Canadian government's objective of energy self-sufficiency by providing a secure, long-term supply of natural gas to an area of Canada now largely served by insecure imported oil.

TCPL submitted that another aspect of security of supply was refinery upgrading. If, as expected, refiners were required to import heavier crude oils in future, then more crude oil would be required to make the same volume of lighter transportation products, and this would increase rather than reduce reliance on foreign energy supplies.

Although TCPL recognized that there were potential new energy sources off Sable Island and other East Coast areas, it submitted that the proposed pipeline facilities should be constructed as soon as possible to increase self-sufficiency in the near term and to complement these future developments.

In its cost-benefit analysis, TCPL stated that the security of supply value of the pipeline extension would be the saving in the expected loss of output in the Quebec economy resulting from the curtailment of that portion of the oil imports which would be displaced by natural gas penetration. Based on an assessment of the probability of oil import curtailments over the period 1980-2000, TransCanada estimated the present value of this benefit to be \$401.4 million in 1979 dollars.

10.1.2 Views of Intervenor

Several intervenors, including CPA, IGUA, Norcen, and the Province of Ontario supported the pipeline extension to Quebec City for security of supply reasons. Because a subsidy would be required, such support was often conditional. For example, IGUA stated that any certificate issued for the proposed pipeline to Quebec should be conditional upon there being assurance that contributions to transmission and distribution costs, which would be necessary to make natural gas competitive, would be forthcoming from government subsidies.

Witnesses for the Province of Quebec indicated the important role of hydro-electricity in the Province, because of its abundant supply, but said that natural gas would still be required to reduce dependence on oil supply from foreign sources.

In respect to submissions made on the timing of East Coast supply, Quebec stated that historically there was a significant time lag between the discovery and the eventual marketing of new supplies. Quebec supported extension of service in the Province and, to assist natural gas penetration, stated that it would remove the provincial sales tax on natural gas.

In an analysis of the Quebec refining industry, BP stated that it was in the national interest "to aggressively develop the production of synthetic crude oil in Canada concurrently with the extension of a domestic natural gas pipeline", one reason being to provide a hedge against "severe" market disruption. BP stated that synthetic crude had the potential of making a larger, yet complementary, contribution to national self-reliance than a natural gas pipeline extension.

Gulf stated that it had studied alternative ways of achieving self-sufficiency within certain time frames, self-sufficiency being defined as zero imports of oil. Gulf agreed that extension of gas service in Quebec would be one element of this program. However, Gulf stated, as did Ultramar, that upgrading of refineries in Quebec and the Maritimes would be required to eliminate heavy fuel oil displaced by natural gas penetration. Otherwise, natural gas penetration would not reduce crude oil import requirements.

Ultramar submitted that extension of natural gas service would not increase self-reliance as crude oil would still have to be imported to meet the demand for transportation fuels. It was of the view that natural gas expansion should be considered in the context of other alternatives to reduce dependence on imported oil, such as the extension of the Interprovincial Pipe Line system to Quebec City, termination of exports of crude oil and measures to promote investment in refinery conversion equipment. Ultramar stated that the latter would ensure most efficient use of crude oil within Canada and would allow potential heavy fuel surpluses to be processed into lighter products.

### 10.1.3 Views of the Board

In its cost-benefit analysis discussed in Chapter 8 of this report, the Board has estimated a security of supply benefit associated with the TCPL project as being the cost of providing the same level of protection or security by an alternative method, i.e., strategic storage of crude oil in salt caverns in Eastern Canada. In that analysis it is assumed that the cost of the alternative would include the capital and operating costs of strategic storage required to provide ninety days protection plus the cost of the oil. The present value of this benefit was estimated to be \$89 million in 1979 dollars. This benefit would be higher if it were assumed that the protection provided should be greater than 90 days because a larger portion of the annual gas flow would be providing security of supply.

In summary, it is the Board's view that extension of the pipeline system in Quebec would reduce the dependence of Eastern Canada on imported oil, although, in percentage terms, the volumes of petroleum products displaced in the early years would not be great. Over the longer term, development of resources off the East Coast, in the Mackenzie Delta, Arctic Islands and Beaufort Basin, in combination with more efficient energy use, will also contribute to self-sufficiency. When viewed in relation to the timing of potential production from these energy sources, the Board believes that extension of gas service in Quebec represents effective action to increase security of supply in the short term and that it is a useful initiative in moving toward greater energy self-reliance.

## 10.2 Q & M

### 10.2.1 Evidence of the Applicant

Q & M submitted that approval of the project in all three provinces should be granted on the basis that securing energy supply in these areas was an "urgent problem requiring an immediate solution". Q&M cited the recent political upheaval in Iran, increased political tension in the Middle East, and the limited security provided by 30-day contracts



between oil companies and foreign suppliers. Q & M stated that energy self-sufficiency had become a national objective because of the detrimental effect of rising oil prices on our "economic wellbeing".

Q & M's position was that only natural gas could make an immediate contribution to alleviate the supply problem although over the longer term such alternatives as domestic East Coast supply, synthetic crude, renewables and additional use of coal in Nova Scotia would become available. Q & M undertook that before beginning any construction in the Maritimes it would review developments with respect to East Coast supply and make its study available to the Board. The study would also address whether East Coast supply would affect the proposed pipeline design.

Finally, Q & M stated that the security of supply benefit provided by the pipeline could be measured by the extent it afforded protection from disruptions in the supply of imported oil. Q & M did not quantify the amount of this benefit.

#### 10.2.2 Views of Intervenors

Although CPA, IGUA, Norcen and Ontario supported extension of natural gas service to Quebec City for security of supply reasons, they stated that the amount of security provided by natural gas extension to the Maritimes, as measured by the volume of crude oil imports that would be displaced, was not significant and, consequently, they could not support the proposed extension to the Maritimes.

CPA, Norcen, New Brunswick, and Ontario submitted that a decision by the Board on extension to the Maritimes should be delayed until more information became available on some of the medium to longer term alternatives such as supplies of oil and gas from the East Coast, the Arctic Islands and the Beaufort Basin. Newfoundland suggested that the Board delay a decision until after the release of the study on hydro-electric developments in Labrador at the end of April 1980.

New Brunswick, Nova Scotia and Texaco submitted that protection of the Atlantic region from supply curtailments could be provided by strategic oil storage in salt caverns and/or reversal of one line of the



Portland Pipe Line system to transport available Canadian oil. Ultramar stated that extension of the Interprovincial Pipe Line system from Montreal to Quebec City could be used to make Western Canadian heavy oil available to its Quebec refinery and by transshipment to Atlantic refineries.

CPA stated that the risk of a supply interruption should be weighed against the cost of eliminating the risk. In respect to the Maritimes it was CPA's view that the cost would be high, whereas the amount of oil displaced would be insignificant. This view was also expressed by Norcen.

IPAC submitted that a natural gas pipeline to the Maritimes was not a solution to the short-term problem of security because of the slow build-up of natural gas sales. Over the longer term there could well be energy supplies from Hibernia, Sable Island, the Beaufort Basin and the Arctic Islands. Increased supplies of Western Canadian oil were also possible. IPAC stated that the demand for natural gas in extension markets was a matter of price rather than security of supply, citing the reluctance on the part of Quebec and Nova Scotia to participate in the subsidies which would be required.

New Brunswick agreed that the availability of gas would make a contribution to the Province's security of supply but that the security of oil supply to the Atlantic area could be considerably increased at a modest cost by upgrading the facilities of the Interprovincial Pipe Line and reversing one line of the Portland Pipe Line system.

Nova Scotia stated that extension of natural gas service was required for reasons of security, particularly over the next ten years. Supplies of heating fuels to the Atlantic Region from imported oil would become more uncertain in future years and substitution of natural gas for oil would play a major role in achieving self-sufficiency. Nova Scotia was also planning to reduce oil imports over the longer term by

substituting coal for oil in thermal electric generation. Nova Scotia stated that natural gas from western Canada could actually enhance the potential development of East Coast natural gas by opening up markets. It therefore stressed that the pipeline system and the sales contracts should make provision for an eventual reversing of direction of natural gas flow.

Nova Scotia addressed the value of security of supply in terms of the costs of various alternatives namely, risking the economic damage resulting from an interruption of oil imports, providing strategic oil storage, or reversing one line of the Portland Pipe Line system. Although it found the pipeline reversal to be the best of these alternatives, Nova Scotia acknowledged that it should also provide for strategic oil storage.

Texaco stated that extension of natural gas service to Quebec and the Maritimes would be detrimental rather than beneficial to achieving energy self-sufficiency. Although domestic crude oil supply to Eastern Canada could not be increased to provide the same level of security as the natural gas pipeline in the same time frame, it would be better in the long term to invest in the development of domestic crude oil supply. Texaco stated that such contingencies as supply disruptions in OPEC countries and refinery operating problems could be better met by a 180 day supply of oil stored in Canada than by a natural gas pipeline. On the basis of published reports Texaco suggested that the capital cost of storage in salt caverns would amount to \$18.87 per cubic metre.

Mobil provided the Board with information on the wells near Sable Island which it had drilled and which had tested natural gas at a significant rate. Mobil described its planned program for this area and noted that a decision as to the commercial viability of the project could not be made before early 1982, with the delivery of natural gas not before 1986. As operator for the area around the Hibernia discovery well, Mobil indicated that while it was encouraged by the test results, the earliest that production of oil could be achieved was 1985.

### 10.2.3 Views of the Board

The Board has estimated the present value of the security of supply afforded by the proposed Q & M pipeline in its cost-benefit analysis and found it to be \$38 million in 1979 dollars. This benefit is based on the cost of providing alternative protection by strategic oil storage against an oil import curtailment lasting 90 days.

The Board recognizes that the question of security of supply in the Maritimes is complicated by the development of potential supplies of natural gas and oil off the East Coast. If these supplies became available over the time period suggested at the hearing, they would provide the Atlantic region of Canada with the most effective security. The timing of the availability of such supplies will be determinable to a much greater degree upon completion of exploratory and development wells now being drilled or planned to be drilled this year.





CHAPTER 11  
DECISION

Throughout the previous chapters of this report, the Board has set out a summary of the evidence, submissions, and arguments of the two Applicants, TransCanada and Q & M, and the evidence, submissions, and arguments of intervenors, and has expressed its own views and conclusions on a wide variety of issues that were raised at the public hearing on the applications for certificates of public convenience and necessity with respect to proposed pipeline facilities in the Provinces of Quebec, New Brunswick, and Nova Scotia. The Board has carefully considered all of the evidence, submissions, and arguments made before it concerning these applications and has taken into account all matters that appear to it to be relevant in considering these applications.

11.1 TransCanada's Application

The Board is satisfied that the pipeline facilities applied for by TransCanada under its non-export case are and will be required by the present and future public convenience and necessity, with the exception of the Marelau-to-Thurso portion of the Thurso lateral, the looping of the existing St-Lazare-to-St-Mathieu section of the TransCanada system, the receipt metering station at St-Mathieu, and the compression facilities that were not planned to be constructed before the operating year 1984-85.

With respect to the facilities applied for by TransCanada under its export case, the Board is not satisfied that these facilities are and will be required by the present and future public convenience and necessity. The reasons for this decision are to be found in section 11.2. On the question of markets, TransCanada's forecast of sales of natural gas in expansion markets in the Province of Quebec was based on certain incentive pricing arrangements being in place to permit natural gas to displace other fuels in existing uses and to compete successfully with other fuels for new uses. The Board agrees with TransCanada and with other parties to the hearing that incentive pricing measures will be necessary to promote the use of gas, and the Board finds TransCanada's

pricing assumptions to be reasonable. If these pricing assumptions are realized, it is apparent to the Board that there is a significant potential market for natural gas in the areas proposed to be served in the Province of Quebec, although the Board's own forecast, based on the same incentive pricing assumptions, is somewhat lower than that of TransCanada.

As to the availability of gas for the markets proposed to be served, the Board is satisfied that TransCanada has sufficient supply to meet its requirements in the Quebec expansion markets until 1985, and the Board is satisfied that TransCanada will be able to contract for more gas in Alberta to make up any deficiency that may occur afterwards.

The Board agrees with the general location of the proposed pipeline route, and it is satisfied with the engineering design and construction methods, subject to the following exceptions. For the reasons explained in section 6.1.1.9, the Board does not approve the construction of the Marelán-to-Thurso portion of the proposed Thurso lateral. As indicated in Chapter 6 of this report, due to the uncertainty associated with forecasting future market demand, the Board does not approve the compression facilities that were not planned to be constructed before the operating year 1984-85. For the same reasons, the Board does not approve the looping of the existing St-Lazare-to-St-Mathieu section of TransCanada's system.

In its interim decision, dated February 1980, the Board did not approve the receipt metering station proposed for St-Lazare and, now, the Board does not approve the receipt metering station for St-Mathieu. These two metering stations, which would be required to record the transfer of gas ownership, are not needed until an application has been made for an assignment or transfer of the certificate to the joint venture, as planned by TransCanada and Q & M, as explained in section 6.1.3.3, and until such an assignment or transfer has been authorized by the Board and approved by the Governor in Council.

With respect to the cost estimates submitted by TransCanada for those facilities that the Board is prepared to approve at this time, the Board concludes that these estimates are reasonable for the most part. The Board finds, however, that the escalation rates used by TransCanada are somewhat conservative.

The Board has carefully considered the evidence before it on right-of-way and environmental matters and is satisfied that construction of the proposed pipeline system can be accomplished with minimal adverse effect provided TransCanada implements all the land acquisition and related policies and environmental protection practices and procedures presented to the Board. The Board has previously outlined specific areas of concern and believes that the conditions set forth earlier in this report will meet these concerns.

Turning to sales contracts and financial matters, TransCanada's estimates of sales to distributors were based on certain incentive pricing assumptions. It is the view of the Board that absent some form of incentive pricing measures, either those assumed by TransCanada or some equivalent provisions, the sales of natural gas estimated by TransCanada will not take place. It is a matter of record that distributors will not enter into long-term contracts to purchase gas from TransCanada until some form of pricing and incentive agreement is reached. The Board recognizes that the establishment of these incentives requires agreement between parties other than TransCanada and the distributors.

The Board believes that the viability of the proposed pipeline in Quebec depends on some form of incentive pricing measures, and it is unlikely that sales contracts will be executed prior to resolution of this matter. Nonetheless, the Board, as a key condition of the certificate, will require TransCanada to file executed sales contracts prior to commencement of construction.

Although the Board had before it for determination two applications for certificates under Part III of the Act, certain matters relating to tariffs were raised. The Board made it clear that it would not issue any order relating to these matters under Part IV of the Act as a result of these proceedings. However, the Board recognizes that certain incentive pricing measures will be required to achieve the level of sales forecast by TransCanada, and the Board finds that the proposal of TransCanada to extend the Eastern Zone to include new delivery areas and to offer development rates in the early years of the project are two means of assisting in this regard.



The Board also recognizes that approval in principle of TransCanada's proposed pro forma gas tariff would considerably assist in the financing of the project.

The full implications of TransCanada's proposals on those tariff matters were not examined in these proceedings, but there will be an opportunity for such an examination to take place at a forthcoming TransCanada rate case, should the Governor in Council approve the Board's recommendation on the issuance of a certificate to TransCanada.

The Board concludes that the financing plan proposed by TransCanada is feasible. However, the Board, as a condition of the certificate, will require TransCanada to file information showing that the appropriate arrangements have in fact been made for financing the proposed pipeline facilities, before the commencement of construction.

As was mentioned in section 8.1.1, it is the view of the Board that the likely macroeconomic impacts resulting from the pipeline facilities proposed by TransCanada will be quite small and will be absorbed without difficulty by the Canadian economy. The overall impact of the project should prove to be beneficial.

The Board, after having carefully considered the evidence presented by TransCanada and the views expressed by intervenors, has assessed the regional social and economic impact of the proposed pipeline facilities, as discussed in section 8.1.2 of this report. In summary, the Board is confident that the proposed pipeline and associated distribution facilities can be built without causing any significant socio-economic problems and believes the project can bring economic benefits to the Province of Quebec.

Careful consideration has been given to the evidence provided to the Board concerning the impact of natural gas penetration on the oil refinery industry in Quebec. Although some refiners may encounter difficulties in adjusting in the short term, the Board's view is that the profitability of refinery operations will not be significantly affected by the project.

The Board is satisfied with the approach taken by TransCanada to estimate Canadian content for its project and finds TransCanada's estimate to be reasonable. Because it has certain specific concerns on



this issue, discussed in section 8.1.4.2, the Board will attach certain conditions to the certificate.

After having considered the evidence of TransCanada and the evidence and views of intervenors, the Board has assessed the net economic benefits to Canada of the proposed facilities as outlined in section 8.1.5. The Board concludes that the TransCanada pipeline project will result in substantial net economic benefits to Canada and particularly to the areas of Quebec that will receive natural gas service as a result of the pipeline extension.

The issue of economic viability of TransCanada's project initiated a high degree of participation from the intervenors. This is understandable since the measures that TransCanada suggested be implemented to ensure that the price of gas delivered to the user be competitive in the Quebec expansion market in order to make its project economically viable, would directly affect the producers and TransCanada's existing customers.

Besides the extension of the Eastern Zone to include the entire new market area in Quebec, and the establishment of development rates for the initial years of service in a new area, TransCanada proposed other incentive pricing measures such as the construction of laterals and sub-laterals by TransCanada, the reduction in the price of natural gas for new domestic sales to 65 percent of that of oil, on an energy-equivalent basis, at the Toronto reference point for up to ten years, and the establishment of a mechanism for the transfer to Alberta producers of any surplus remaining after distributors' costs have been recovered.

The Board has made its own assessment of the economic viability of TransCanada's project. The Board has found that TransCanada's project in Quebec is economically viable provided that TransCanada's proposed pricing incentives, or some equivalent provisions, are in place. This conclusion was reached after considering a substantial amount of evidence presented at the hearing and after considering the views and submissions of all parties.

The Board finds that TransCanada's proposed pipeline facilities will increase security of supply by making secure domestic natural gas available to an area of the country now largely dependent on insecure foreign oil. It will contribute to the Canadian Government's objective of energy self-sufficiency by opening up new markets for Canadian natural gas, thereby providing an incentive for increased exploration for natural gas in Canada.

#### 11.2 Q & M's Application

The Board is not satisfied that the pipeline facilities applied for by Q & M, either under its export case or its non-export case, are and will be required by the present and future public convenience and necessity.

As mentioned previously, Q & M's proposal assumed the export of some  $2.57 \times 10^9 \text{ m}^3$  per year of natural gas to the Northeastern United States through a lateral to St. Stephen, New Brunswick. Indeed that was the Joint Applicants' prime case.

The Board had before it an application under Part III of the Act for a certificate to construct and operate pipeline facilities, but did not have before it an application under Part VI for a licence to export gas through the proposed Q & M facilities. Q & M indicated to the Board that a certificate conditional upon the issuance of a licence to export gas would be acceptable to it.

If the exports through the facilities proposed by Q & M were approved, TransCanada would have to install additional facilities in Quebec to transmit increased volumes of gas. The Applicants were not willing to see the construction of the facilities in Quebec delayed until an application for a licence authorizing the export of gas at the New Brunswick/Maine border was disposed of. Rather, it was proposed that TransCanada's facilities be built for the export case, which would cause an additional net expenditure of several million dollars to accommodate the potential export of gas at St. Stephen, whether these exports materialized or not. The Board cannot subscribe to what is asked of it, i.e., to approve the overbuilding of pipeline facilities in order to provide for contingencies of that nature.

Moreover, the Board finds that the evidence presented by Q & M on its export case is incomplete. There was no evidence provided to the Board on the availability of supply for the proposed export volumes under Q & M's export case. With regard to market requirements, the evidence on sales contracts between Pan-Alberta and that company's United States customers was in the form of documents that, it was recognized, were merely agreements to agree and did not constitute firm contracts.

It is, therefore, the Board's view that the additional capital costs associated with the export case are not justified in light of the evidence presented.

Q & M also presented a non-export case, although it submitted that the assumed export volumes under the export case would lend support to the overall economic viability of the pipeline extension east of Lévis/Lauzon into New Brunswick and Nova Scotia by increasing the pipeline throughput and thereby lowering the average unit cost of transmission.

With respect to markets, Q & M's forecast of sales of natural gas in New Brunswick and Nova Scotia was based on certain relative price assumptions under conditions of incentive pricing in order to promote penetration of markets by natural gas in those provinces. The Board agrees that some incentive pricing mechanisms would be necessary to promote the use of gas. The Board adopted Q & M's relative price assumptions for the purpose of developing its own forecast, and the Board was assisted by the evidence adduced by the intervenors. If the assumed relative prices for natural gas were realized, it is apparent to the Board that there would be a potential market for natural gas in the areas proposed to be served in New Brunswick and Nova Scotia, although the Board's own forecast, based on the same relative price assumptions, is lower than that of Q & M, mainly because of a lower estimate of demand for thermal generation of electricity.

As to the availability of gas for the markets proposed to be served, the Board is satisfied that there would be sufficient supply available to meet the projected market demand in New Brunswick and Nova



Scotia until 1985, and that additional volumes of gas would be available in Alberta to make up any deficiency that might occur after 1985.

The Board is generally satisfied with the location of the proposed pipeline route, the engineering design, and the proposed construction methods, with some exceptions, which are noted in sections 6.1 and 6.2. As in the case of the facilities proposed by TransCanada, due to the uncertainty associated with forecasting future market demand, the Board would not be prepared to approve the compression facilities that were not planned to be constructed before the operating year 1984-85. Similarly, the Board would not be prepared to approve the underground storage facilities that would not be needed until the 1989-90 period, and particularly not until a confirmatory drilling program had demonstrated the technical feasibility of constructing such facilities to support the selected design for the underground salt caverns.

The Board has examined the evidence adduced on right-of-way matters and is satisfied that Q & M's proposed pipeline facilities could be built with minimal interference with existing or potential land uses, and that necessary arrangements have been or would be made with all levels of government regarding the project with respect to land use and related matters. The Board is also generally satisfied with Q & M's proposed land acquisition procedures.

The Board has carefully reviewed the evidence presented on environmental matters, and, in section 6.2.5.5, the Board has expressed its views on Q & M's evidence relating to these matters. Without repeating all of its views, the Board wishes to stress that Q & M has not satisfied the Board that the pipeline could be constructed in an environmentally acceptable manner.

With respect to sales contracts and financial matters, the views of the Board on Q & M's application parallel its views on TransCanada's application. If a certificate were issued to Q & M, the Board would require all pertinent sales contracts to be filed prior to the commencement of construction.

As was mentioned in section 8.2.1, it is the Board's view that the combined macroeconomic impact of the TransCanada and Q & M pipelines would likely be small and beneficial. Of greater importance is the



impact on Canada's regions, specifically Quebec and the Maritimes. The Board has assessed the regional social and economic impact of the Q & M application. The Board believes that as a result of Q & M's policies, any negative aspects of the project's social impact as well as its impact on local infrastructure and facilities could be kept to a minimum. The Board also believes that the project could bring economic benefits to the Provinces of Quebec, New Brunswick, and Nova Scotia, although the Board's estimates in that regard are lower than those of Q & M.

On the question of the impact of natural gas penetration on oil refineries in the Maritimes, the Board finds that the displacement of light and heavy fuel oil could create additional short-term problems for Atlantic refineries currently operating below capacity, although some of these problems could be alleviated, for instance, by increased heavy fuel oil exports.

The Board is satisfied with the approach taken by Q & M to estimating Canadian content and finds its estimate to be reasonable.

As outlined in section 8.2.5, the Board has assessed the net economic benefits to Canada of the proposed Q & M pipeline facilities and concludes that the net economic benefits of such facilities are smaller and less certain than those associated with the facilities covered by TransCanada's application for extension of its system in the Province of Quebec. On the other hand, the Board notes that future increases in imported oil prices would lead to economic benefits associated with the Q & M project improving faster than would be the case with TransCanada's project in Quebec.

As discussed in section 9.2, Q & M provided evidence that the combined Q & M and TransCanada projects could be economically viable as a result of its proposed and assumed pricing and tariff provisions in the sense that overall distributor revenues would be sufficient to cover the costs of gas at the distributors' city-gate. The Board agrees with this contention and estimates that the combined projects could be economically viable, provided the Applicants' proposed and assumed pricing incentives, or some equivalent provisions, are in place. The Board has examined the Q & M project separately, using the proposed pricing and tariff

assumptions of both Applicants and finds that the viability of the Q & M project alone cannot be reasonably assured under the proposed conditions because, even after five or six years, the distributors' profits would be small, and some further incentive pricing measures would have to be put in place to assure the economic viability of the distributors and thus of the proposed Q & M project itself.

Many of the reasons that led the Board to recommend the issuance of a certificate of public convenience and necessity to TransCanada for the proposed extension of its system in the Province of Quebec also apply to the Q & M proposal. The proposed pipeline to the Maritimes would increase security of supply in New Brunswick and Nova Scotia, two provinces now largely dependent on foreign oil, and, by reducing oil imports, would improve Canada's balance of payments. It would also contribute to the Canadian Government's objective of energy self-sufficiency by opening up new markets for Canadian natural gas, thereby providing an incentive for increased exploration for natural gas in Canada. In dealing with the Maritimes, however, the analysis of the question of security of supply is complicated by the development of potential supplies of natural gas and oil off the East Coast. The Board heard considerable evidence on these offshore resources during the hearing.

The Board is not satisfied that Q & M has given adequate consideration to the impact on its project of oil and gas developments in the offshore areas of Eastern Canada, although Q & M did undertake to review the developments with respect to East Coast supply and to file with the Board, by the end of 1980 and prior to commencement of construction, an East Coast offshore study, which would also address the question of whether East coast supply would affect the proposed pipeline design. Q & M suggested that an appropriate condition be attached to the certificate in that regard.

The Board believes that the evidence adduced on offshore resources raises significant uncertainties as to the configuration of the Q & M pipeline and the Board is not satisfied that the pipeline facilities proposed to be built and operated by Q & M are and will be required by the present and future convenience and necessity.

The Board concludes that it cannot recommend the issuance of a certificate of public convenience and necessity to Q & M for the facilities applied for under either its export or non-export case. The Board believes that the timing of the availability of the reserves of oil and gas in the East Coast offshore areas will be more determinable upon completion of drilling of exploratory and development wells, now underway or planned. This will have a bearing on the design and feasibility of a gas pipeline serving markets east of Lévis/Lauzon, and Q & M may wish to make a new application.

### 11.3 Joint Venture

The Joint Applicants, TransCanada and Q & M, have told the Board that they have agreed that any certificate or certificates granted would be held in a fiduciary relationship for the benefit of both until they had applied for and received approval for assignment or transfer of the certificate(s). Until that time, TransCanada would remain fully responsible to the Board for any of the facilities in the Province of Quebec up to Lévis/Lauzon, and Q & M would remain fully responsible for any certificate granted in respect of the pipeline east of Lévis/Lauzon. The Applicants indicated that they would apply to the Board for a transfer of any certificate to a joint venture corporation.

Until any assignment or transfer of a given certificate has been authorized by the Board and approved by the Governor in Council, the holder of that certificate remains fully responsible to the Board for any facilities constructed and operated under such certificate.

### 11.4 Disposition

Having regard to the foregoing considerations, findings, and conclusions, and having taken into account all matters that appear to it to be relevant, and bearing in mind that Certificate of Public Convenience and Necessity No. GC-64 has been issued to TransCanada for the pipeline facilities located between St-Lazare and Boisbriand as a



result of an interim decision, dated February 1980, the Board, being satisfied that the pipeline facilities applied for by TransCanada under its non-export case, from the Boisbriand junction to Lévis-Lauzon, including laterals and sub-laterals, with the exception of the Marelan-to-Thurso portion of the Thurso lateral, the looping of the existing St-Lazare to St-Mathieu section of TransCanada's system, the receipt metering station at St-Mathieu, and the compression facilities that were not planned to be constructed before the operating year 1984-85, are and will be required by the present and future public convenience and necessity, is prepared to issue to TransCanada a certificate of public convenience and necessity in respect of the above-described facilities, upon the terms and conditions set out in Appendix 11, subject to the approval of the Governor in Council.

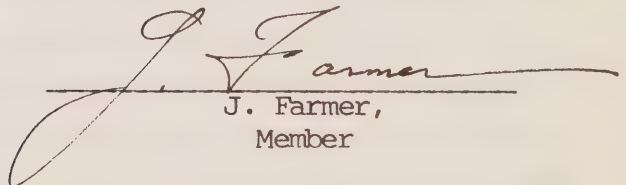
Having regard to the foregoing considerations, findings and conclusions, and having taken into account all matters that appear to it to be relevant, the Board hereby denies Q & M's application.

\* \* \* \* \*

All of which is respectfully submitted.



J.G. Stabback,  
Presiding Member



J. Farmer,  
Member



J.R. Jenkins,  
Member



TransCanada

1. The additional pipeline to be constructed pursuant to this certificate shall be the property of and operated by TransCanada.
2. (1) TransCanada shall cause the additional pipeline, in respect of which this certificate is issued, to be designed, manufactured, located, constructed and installed in accordance with those specifications, drawings and other information or data set forth in the application as amended, or as ordered, directed, or approved by the Board, unless varied in accordance with sub-condition (2) hereof, and those that are otherwise filed with the Board.  
(2) TransCanada shall cause no variation in the specifications, drawings, other design data and requirements described in subcondition (1) hereof to be made without prior approval of the Board.
3. With respect to each segment of the additional pipeline, TransCanada shall submit to the Board for its approval, prior to commencement of construction of that segment:
  - (a) final specifications for line-pipe, pipeline components and pipeline coating, along with final stress analysis, fracture control design and up-to-date specifications for materials,
  - (b) the construction schedule and detailed drawings of all river and lake crossings and typical crossing drawings for all other bodies of water to be crossed by the said pipeline,
  - (c) site-specific studies forming the basis of the final design for the stabilization of slopes at river crossings and other escarpments, and
  - (d) a copy of the population density count within 200m of either side of the pipeline for each 1.6 km of its length.
4. TransCanada shall submit to the Board, prior to commencement of construction of the St. Flavien lateral, copies of gas supply contracts with la Société Québécoise d'Initiatives Pétrolières (SOQUIP).

5. TransCanada shall file with the Board, concurrent with the filing of plans, profiles and books of reference, the following items:

- (i) line lists for the proposed pipeline route;
- (ii) a listing of all properties where it is anticipated that expropriation procedures will be required;
- (iii) details of joint use of rights-of-way for the Eastern Townships system, and
- (iv) the location of any mine, mining claim or borrow resources along the proposed route.

6. Prior to the commencement of the construction of the additional pipeline, TransCanada shall submit for approval, reports containing the following information:

- (i) an evaluation of the practicality of following existing transportation corridors to minimize the effect of the pipeline construction activities on agricultural land and sugarbush lots, and a description of any constraints which would preclude this; and
- (ii) the detailed measures it proposes to implement each year to ensure that the contractors and their employees are fully cognizant of the environmental concerns and of the environmental procedures to be followed along the proposed pipeline route.

7. Prior to the commencement of hydrostatic testing of any portion of the additional pipeline, TransCanada shall submit for approval, a report containing a description of the location of municipal, industrial and domestic water intakes in relation to water withdrawal sites and discharge to ensure that no damage is done to aquatic habitat, fish resources or water users downstream;

8. TransCanada shall, unless otherwise authorized or ordered by the Board, implement or cause to be implemented all the policies, practices, recommendations and procedures for the protection of farmlands and the environment which are included in TransCanada's environmental reports,

its Construction Specifications, its Environmental Procedures Handbook, or as otherwise adduced in evidence before the Board, and shall cause no changes to be made to the said policies, practices and procedures without the prior approval of the Board.

9. TransCanada shall conduct noise level surveys at each compressor station during the first year after start-up under representative weather conditions and with the compressor station operating under normal load; and shall submit the results of these surveys to the Board to verify that noise emission does not exceed the level of 55dBA.

10. TransCanada shall, within six months of leave to open being granted, unless upon application by TransCanada a later day is fixed by the Board, submit a report satisfactory to the Board describing the implementation of the policies, practices, recommendations and procedures referred to in Condition 8 above; this report shall include:

- (i) details of any deviation and
- (ii) an assessment of the effectiveness of the said policies, practices, recommendations and procedures.

11. TransCanada shall, both during and after the construction period, monitor the effects of the construction of the additional pipeline upon farmlands and the environment and shall submit reports satisfactory to the Board describing such effects; these reports shall be filed:

- (i) within one year of the date of leave to open being granted and
- (ii) prior to 1 November following the second complete agricultural growing season after leave to open being granted.

These reports shall include the results of the monitoring programs and the actions taken or which will be taken to prevent or mitigate any long-term effects of construction upon farmlands and the environment.

12. TransCanada shall, prior to commencement of construction, submit to the Board information showing that appropriate arrangements have been made for financing the additional pipeline.

13. With respect to each segment of the additional pipeline, TransCanada shall file with the Board prior to the commencement of construction of that segment a copy of the contract or contracts for the sale of natural gas in those areas to be served by the additional pipeline facilities.

14. TransCanada shall cause the construction and installation of the additional pipeline to be completed on or before 1 December, 1985, unless, upon application by TransCanada, a later date is fixed by the Board.











